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ERS Staff Report
No. AGESS 810504

Appendix D

Program Definitions and Public Costs

Beltwide Boll Weevil/Cotton
Insect Management Programs

Program Definitions and Public Costs, Beltwide Boll Weevil/Cotton Insect Management Programs. Overall Evaluation Appendix D. Natural Resource Economics Division, Economics and Statistics Service, U.S. Department of Agriculture, Washington, D.C. May 1981. ERS Staff Report No. AGESS810504.

ABSTRACT

Implementation plans were outlined and respective public costs were estimated for six beltwide boll weevil/cotton insect management programs in boll weevil-infested areas. Public cost is only one component of an economic evaluation of alternative programs. If fully implemented, annual public costs of the programs would be: current insect control (CIC), $2.5 million; optimum pest management with incentives (OPM-I), $36 million; OPM with phased incentives (OPM-PI), $7 million; OPM with no incentives (OPM-NI) $7 million; OPM-NI with boll weevil eradication (OPM-NI-BWE), $7.5 million; and CIC-BWE, $3 million. However, estimated public and private costs would total $460 million during the 9 years to eradicate the boll weevil. Also, public costs for diapause treatments for the OPM program with phased incentives would total about $61 million during the 3 years of implementation.

Keywords: Cotton, boll weevil, insect management, public costs

PREFACE

This report presents estimates of public costs associated with alternative boll weevil/cotton insect management programs in weevil-infested areas of the Cotton Belt. It also contains a description of beltwide implementation plans. The report is submitted by the Program Definition and Cost Facilitator Group as an integral part of the evaluation of beltwide cotton insect management programs. The membership of this Group follows:

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Chief contributors to this report were the members of the Optimum Pest Management Regional Extension Education Advisory Committee (OPMREEAC) coordinated by David Young, Leader of Extension Entomology, Mississippi Cooperative Extension Service; and James Brazzel, Plant Protection and Quarantine, APHIS, USDA, who prepared the estimates for boll weevil eradication.

Members of OPMREEAC were: Jack Bacheler, NC; Donald Johnson, SC; W.R. Lambert, GA; Ron Smith, AL: Jimmy Pendergrass, TN; Ed Kowalski, MO; Jim Hamer, MS: Gordon Barnes, AR; James Tynes, LA; Mike McWhorter, TX; and Eldon Cleveland, OK.

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TABLES

ACRONYMS

APHIS	Animal and Plant Health Inspection Service, USDA
ASCS	Agricultural Stabilization and Conservation Service
B/C	Benefit/Cost Ratio
BWE	Boll Weevil Eradication or Trial
CES	Cooperative Extension Service
CIC	Current Insect Control
CIC-BWE	Current Insect Control with Boll Weevil Eradication
ESS	Economics and Statistics Service, USDA
MOPM	Modified Optimum Pest Management Option
NCDA	North Carolina Department of Agriculture
OBP&E	Office of Budget, Planning and Evaluation, USDA
OPM	Optimum Pest Management Option or Trial
OPM-NI-BWE	Optimum Pest Management with No Incentive and Boll Weevil Eradication
OPM-I	Optimum Pest Management with Continuing Full Incentive Payments to Producers for Diapause and/or Pinhead Square Treatments
OPM-NI	Optimum Pest Management with No Incentive Payments to Producers
OPM-PI	Optimum Pest Management with Phased Incentive Payment to Producers
OPMREEAC	Optimum Pest Management Regional Extension Education Advisory Committee
SEA-AR	Science and Education Administration-Agricultural Research, USDA
VADAC	Virginia Department of Agriculture and Commerce

SUMMARY

A Program Definition and Cost Facilitator Group specified guidelines and coordinated the review of definitions and the estimation of public costs of beltwide boll weevil/cotton insect management programs. The final definitions were developed and approved by SEA-ES and APHIS personnel in consultation with Optimum Pest Management Regional Extension Education Advisory Committee (OPMREEAC) members, the Overall Evaluation Team, and Facilitator Group representatives.

Six boll weevil/cotton insect management programs were defined: (1) Current Insect Control (CIC); (2) Optimum Pest Management with Continuing Incentives for Boll Weevil Management (OPM-I); (3) OPM with Phased Incentives (OPM-PI); (4) OPM with No Incentives (OPM-NI); (5) OPM-NI with Boll Weevil Eradication (OPM-NI-BWE); and (6) CIC with Boll Weevil Eradication (CIC-BWE).

The beltwide OPM programs consist of two major insect management options--Optimum Pest Management (OPM) and Modified Pest Management (MOPM)--whichever is most applicable for a particular area. Additional Extension personnel and support would be required to implement both options.

- The OPM option would utilize the boll weevil/cotton insect management practices that were tested in the Mississippi Trial with emphasis on area-wide diapause and/or pin-head square treatment, as needed, and varying levels of reimbursement to producers for the cost of these treatments.

- The MOPM option would be followed in all areas where the area-wide diapause strategy could not be implemented or where it is not needed. It would utilize, if applicable, all of the practices tested in the Mississippi Trial except the organized area-wide diapause strategy but may include voluntary diapause treatments by individual producers.

The beltwide eradication component of OPM-NI-BWE would utilize technology proven by the North Carolina trial and ongoing research. Eradication would begin in the Southeast and proceed west through eight separate zones, followed by the maintenance of a buffer zone between U.S. and Mexico to inhibit reinfestation. To insure sufficient implementation, OPM-NI would be in place prior to, during, and following eradication. The CIC-BWE program would be implemented with present level of funding for Extension education for cotton insect management prior to, during, and following eradication.

The pattern of public costs for each of the beltwide programs varies considerably from initiation through full implementation.

- The CIC and three incentive related OPM programs would be funded through CES while the eradication programs, CIC-BWE and OPM-NI-BWE, would be jointly funded by CES and APHIS.

- CIC, the baseline program, is currently costing about $2.5 million annually and it would continue at that rate.

- The funding for the OPM-I program with continuing incentive payments would increase from about $6 million the first year to $36 million by the second year and remain at that level.

- The costs for OPM-PI would be similar to OPM-I during the first two years but would decline to $7 million by the fifth year.

- The OPM-NI program costs would increase to $7 million by the second year and continue at that rate.

- Compared with OPM-NI, during the first year about $1 million more would be needed under the OPM phased and full incentives programs to prepare producers for the area-wide diapause strategy.

- With the eradication programs, OPM-NI-BWE and CIC-BWE, the costs rise to $94 and $87 million, respectively, in the fifth year and decline to $8 and $3 million by the twelth and subsequent years depending on whether the OPM or CIC Extension support is provided. It would cost an estimated $460 million, including capital investments, during the 9 years to eradicate the boll weevil. If farmers share part of the eradication costs, public expenditures for eradication would be reduced.

DEFINITIONS AND PUBLIC COSTS OF BELTWIDE BOLL WEEVIL/COTTON INSECT MANAGEMENT PROGRAMS

INTRODUCTION

An important element in the economic evaluation of alternative beltwide programs is public costs. Their estimation requires an acceptable and well-understood set of program definitions. Acceptable program definitions are also required to estimate beltwide farmer costs of insecticide use and differences in lint yields associated with each program.

The Program Definition and Cost Facilitator Group specified the final guidelines for developing a consistent set of definitions and for estimating public costs for beltwide boll weevil/cotton insect management programs. They also facilitated a review and evaluation of the alternative program definitions and their estimated public costs by the responsible Program Operations personnel and Evaluation Teams. The overall goal of this Group was to insure that the best possible cotton insect management programs were defined and the appropriate public cost estimates were provided for evaluation. The development of final program definitions and public costs, however, remains the primary responsibility of the Science and Education Administration - Extension Service (SEA-ES) and the Animal and Plant Health Inspection Service (APHIS).

Development and Review Procedures

The initial request for information on Optimum Pest Management (OPM) was addressed to the OPM Regional Extension Education Advisory Committee (OPMREEAC). Its membership consisted of one Cooperative Extension Service (CES) cotton entomologist from each of 11 cotton producing States in boll weevil infested areas. These entomologists developed the Optimum Pest Management (OPM) program specifications and estimated the public expenditures for program operations in their respective States. Each entomologist developed his State's program within the overall guidelines and program definitions.

A similar request for information on a beltwide boll weevil eradication program was addressed to the Plant Protection and Quarantine Staff in APHIS. Both the Boll Weevil Eradication (BWE) plan and the OPM plans were received by the evaluation teams prior to the Facilitator Group's establishment. These materials provided a basis for developing the final guidelines and establishing the review procedures.

The primary activities of the Program Definition and Cost Facilitator Group were to:

1. Summarize the program cost estimates submitted by Cooperative Extension Service (CES) and APHIS;

2. Compare the technologies and other components specified under the alternative program definitions;

3. Make a comparative analysis of program costs;

4. Stimulate the members of the evaluation teams to conduct a comprehensive review of the numbers and the definitions for reasonableness and consistency; and

5. Interact with the biological, economic, and overall evaluation teams to insure that the program definitions and specifications were clearly understood. Since the program definitions provided the common foundation for all of the evaluation components, it was important to assure that each was structured to reflect the unique characteristics of each program.

The cost estimates were reviewed for consistency with the definitions and assumptions for program operations. The costs were compared across production regions and States. Program personnel were contacted in writing or in person to determine if revisions were needed. Advice and guidance were provided, but no revisions were made without approval or consent of the respective program operations personnel.

The first meeting of the Facilitator Group was held in Sardis, MS on July 28-30, 1980, in joint session with the OPMREEAC members. A review of program definitions, components, and costs at that meeting indicated several remaining problems and inconsistencies. A set of revised assumptions and guidelines for use in estimating OPM costs were developed at that meeting. The discussion also resulted in the addition of an eradication program, without increased funding of Extension education, as a sixth program to be evaluated. It also showed that more work was needed to reach a common understanding of the various OPM programs.

The OPM program definitions were an agenda item at several subsequent meetings. The greatest concern centered around how to modify the OPM option in areas where diapause and pin-head square technologies were not needed or were not likely to be adopted by a sufficient number of producers so as to even be marginally effective. In such areas, better in-season control of boll weevils, including other cotton pests, would be a more effective strategy.

The Group decided that a modified optimum pest management (MOPM) option would be implemented in areas where the diapause and pin-head square techniques could not be implemented or would not be needed. As such, it would be considered only as an option of the OPM programs and would not be evaluated as a beltwide program.

The final definitions were presented to the second Delphi Conference in Memphis, TN on October 23-25, 1980.

The program costs to taxpayers were reviewed with each of the State entomologists, Jim Brazzel (APHIS), David Young, (Mississippi CES), and evaluation team leaders. This review showed a need for minor modifications to assure consistency among regions or consistency with accepted budgeting parameters.

The final specifications of program components and their respective costs were reviewed by the Facilitator Group in New Orleans, LA on January 5, 1981 and were subsequently presented to the Overall Evaluation Team and Interagency Work Group. These reviews showed general acceptance of the materials and suggested improvements in presentation.

Guidelines for Specifying Program Components and Public Costs

The following assumptions and guidelines were used by all participants to insure comparability of programs within and among regions:

1. Alternative programs for comparison should be limited to cotton insect control, with emphasis on control of boll weevils. Do not include other cultural practices such as irrigation and fertilizer use for which recommendations apply generally over all specified programs, unless closely related to insect management.

2. Current insect control (CIC) is the baseline for comparison with other alternatives. It also provides a starting point for adjusting control practices and costs to correspond with other control programs.

3. Programs should be defined and components specified for each cotton production region as jointly delineated by CES and ESS.

4. Baseline acreages for all programs will be the 1974-78 average, which is indicative of current trends. Crop Reporting Service acreages should be used in indicating expected program participation, timing of program activities, and costs of programs. Averages for counties are by State and CIC regions.

5. Baseline yields associated with current insect control (CIC) are based on average yields obtained by farmers during the 10 year period 1969-78. This longer-term average represents a normal or expected yield level associated with current practices and avoids annual fluctuations.

6. Normalize infestations of weevils and other cotton insects by assuming a 5-10 year average infestation level. Base all program specifications and costs for year-1 on this perceived long-run level of infestation.

7. Use insect management technologies that have been tested and are recommended for use in 1980. Do not base any program components or costs on projected future technologies or near-known technologies.

8. Estimate costs of programs in 1979 dollars. Do not reflect any forecast of changes in price levels during the implementation period.

9. Specify technologies, practices, and costs for each year during program implementation and following implementation to the point at which adjustments to the program are complete and costs and benefits are stabilized.

PROGRAM DEFINITIONS AND TECHNICAL COMPONENTS

Six boll weevil/cotton insect management programs were defined for the boll weevil-infested areas of the cotton belt (Figure 1). The six programs are: (1) Current Insect Control (CIC); (2) Optimum Pest Management with Continuing Incentives for Boll Weevil Management (OPM-I); (3) OPM with Phased Incentives (OPM-PI); (4) OPM with no Incentives (OPM-NI); (5) OPM-NI with Boll Weevil Eradication (OPM-NI-BWE); and (6) CIC with Boll Weevil Eradication (CIC-BWE). A common requirement of all OPM programs is that additional Extension personnel and support would be required to provide technical assistance and educational guidance in the management of the boll weevil and other cotton insects. In the context of this evaluation, the focus of the term Optimum Pest Management is on insect management.

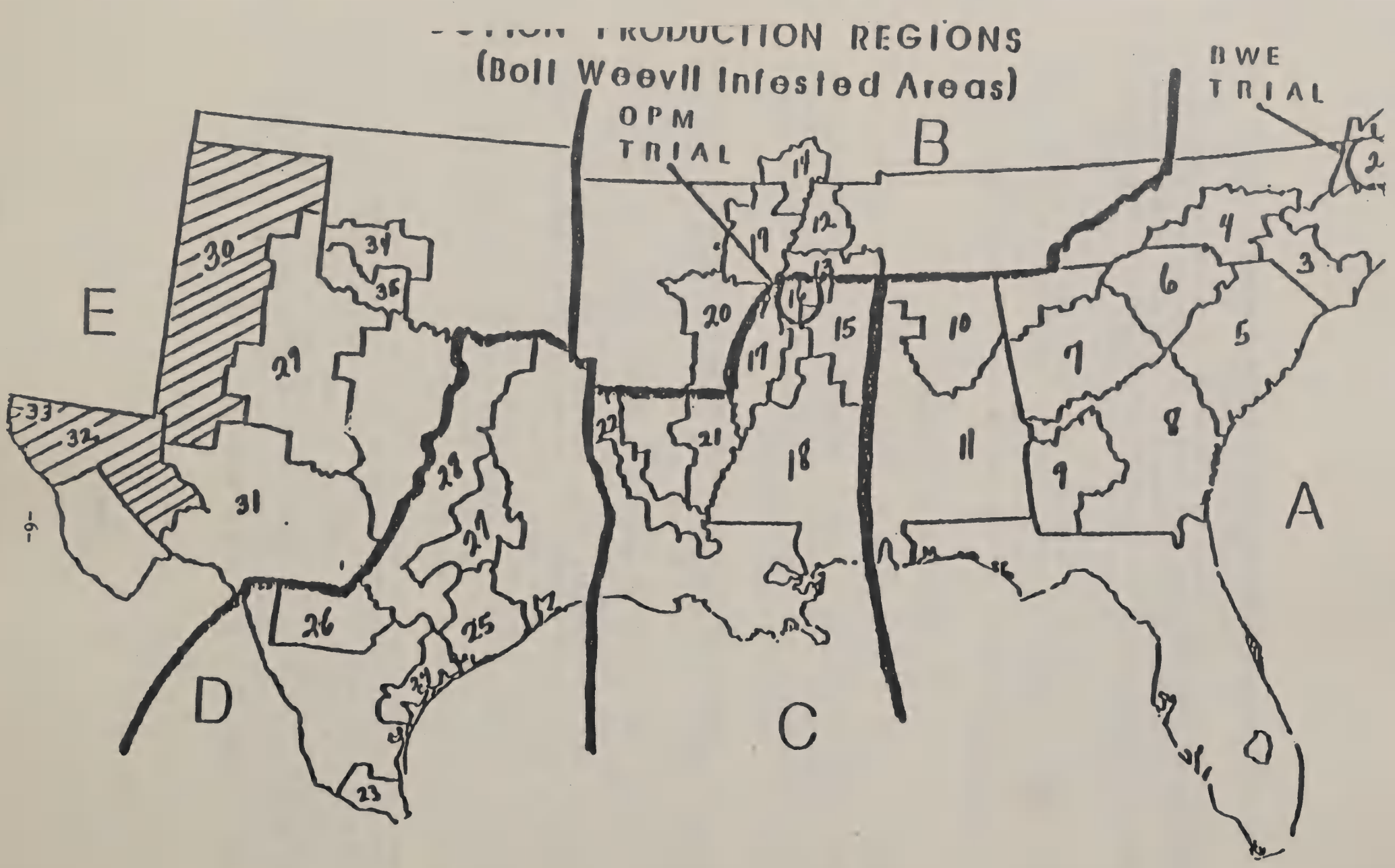
Description of Programs

A general description of the programs for beltwide evaluation follows:

1. Current Insect Control (CIC): Insect control as now practiced by producers ranges from no control to intensive treatment with insecticides. Current insect control implies a continuation of Extension education and technical assistance at the present level of funding.

2. Optimum Pest Management with Continuing Incentive Payments for Boll Weevil Management (OPM-I): This beltwide program consists of two major insect management options, whichever is most applicable for a particular area. Additional Extension personnel and support would be required to implement both options. One option, Optimum Pest Management (OPM), would utilize the boll weevil/cotton insect management practices that were tested in the Mississippi Trial with emphasis on diapause and/or pin-head square treatment, as needed, and full reimbursement for the cost of these treatments. In all areas where the diapause strategy could not be implemented or where it is not needed, an alternate option, Modified Optimum Pest Management (MOPM), would be followed. It would utilize, if applicable, all of the practices tested in the Mississippi Trial except the organized area-wide diapause strategy, but may include voluntary diapause treatments by individual producers.

   In areas having potential for moderate-to-heavy infestations of boll weevils, the OPM option would be implemented where effective. Diapause and/or pin-head square treatments would be specified as recommended technology. The criterion for an effective program is to maintain the mid-season population of boll weevils below treatment levels on 90 percent or more of the acreage prior to onset of Heliothis pressure. Growers would be reimbursed for boll weevil diapause and pin-head square treatments at a level that achieves sufficient acreage to result in an effective program.


PRODUCTION REGIONS
(Boll Weevil Infested Areas)
OPM
TRIAL
BWE
TRIAL
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= AREAS NOT INFESTED WITH BOLL WEEVILS

FIGURE 1

As an example, OPM in Mississippi would include (1) grandlure baited traps as survey tools; (2) producers urged to plant cotton within recommended dates; (3) recommendation and reimbursement for pin-head square application if needed; (4) scouting of all cotton by commercial consultants, grower organizations, CES employees, or trained producers; (5) producers urged to follow CES recommendations for in-season control of boll weevils and other cotton insects; (6) full reimbursement for boll weevil diapause treatments, if needed; and (7) producers urged to destroy stalks if harvested prior to frost.

Consultant and grower organizations would be involved, with CES providing information on recommended insect control practices.

However, in areas, if any, where the required acreage for an effective program could not be reached with the OPM option or where boll weevil infestations are historically light and usually do not reach treatment levels, the Modified Optimum Pest Management (MOPM) option would be implemented. This option implies that the diapause and/or pin-head square technology either could not be adopted on a sufficient percentage of the cotton acreage for an effective area-wide OPM option or it would not be needed because of the low population levels of boll weevil. The objective of MOPM is to reduce the number of unnecessary in-season treatments for boll weevil and other cotton insects through effective scouting and/or monitoring. Examples of areas where diapause and/or pin-head square treatments are not commonly needed include north Alabama, some areas in the Mississippi Delta, Upper Concho area of Texas, and North Oklahoma.

To implement both options under the OPM-I program, additional Extension personnel and funds would be required to provide technical information and educational guidance in the management of boll weevils and other cotton insects. All available proven technology may be applied in implementing this program. Use of the technology recommended and participation in this program would be voluntary on the part of the grower. From 1 to 3 years may be required to fully implement this program, depending on cotton acreage and availability of staff. The acreage that one entomologist can handle will vary because of the location and intensity of cotton acreage as well as historic patterns of insect management problems.

3. Optimum Pest Management with Phased Incentive Payments for Boll Weevil Management (OPM-PI): All recommended program components including personnel and funds are the same as OPM-I except that incentive payments for diapause and/or pin-head square treatments are phased-out over time as follows:

1st year:	Same as OPM-I, 100 percent of needed treatment
2nd year:	75 percent of needed treatment
3rd year:	50 percent of needed treatment
4th year:	No incentive payment

The logic in evaluating this program is that in some areas an incentive may serve to demonstrate the technical and economic feasibility of diapause and pin-head square treatments and that growers may continue the use of these practices. If the required acreage for an effective diapause/pin-head square option could not be maintained after payments are phased out, the MOPM option would be implemented.

4. Optimum Pest Management with No Incentive Payments for Boll Weevil Management (OPM-NI): This beltwide program is the same as OPM-I with the exception that no reimbursements to producers are made for diapause or pin-head square treatments. If the required level of acreage could not be reached, the MOPM option would be established and the diapause/pin-head square technology would not be implemented on an area-wide basis.

5. Optimum Pest Management with No Incentive Payments and with Boll Weevil Eradication (OPM-NI-BWE): This beltwide program includes eradication of the boll weevil as a major component. The beltwide eradication component would use the technology proven by the North Carolina trial and ongoing research. However, it does not need to be a replication of the NC trial.

Boll weevil eradication would begin in the Southeast and proceed west through eight separate zones, followed by the maintenance of a buffer zone between U.S. and Mexico to inhibit re-infestation. To insure efficient implementation of this program, OPM-NI would be implemented beltwide one year prior to the initiation of eradication. MOPM practices for the control of other insects would be in place during and following eradication. The major components of the program to eradicate the boll weevil from a designated zone are: (1) prior to eradication, the voluntary program with no incentive payments to producers (OPM-NI) would involve information and education, organization of producers and encouragement of producers to follow recommended insect control practices; (2) during the first year of eradication, growers would be responsible for inseason control of all insects, including boll weevils. Growers would be urged to follow recommendations for all cotton insects. Beginning in early September (depending on area and weather) APHIS would initiate a boll weevil eradication program with diapause treatments of boll weevils, using guthion, malathion, or other recommended insecticides, as needed. A range of 5-10 treatments are projected on all acreage in infested areas; (3) during the second year of eradication, APHIS would monitor and control incipient boll weevil infestations by the use of sterile weevils, Dimilin, and organophosphorous insecticides, as needed. Growers would be urged to follow recommended practices for control of other insects; and (4) during subsequent years, growers would continue with MOPM practices for the control of other insects in a weevil-free environment, while regulatory agencies would assume responsibility for routine surveillance of the areas cleared (trapping density of 1 per 200 acres) and the control of incipient boll weevil infestations. Following eradication, the Extension Service would continue to provide information to growers on how best to manage cotton insects in the absence of the boll weevil.

6. Current Insect Control with Boll Weevil Eradication (CIC-BWE): This beltwide program includes eradication of the boll weevil as a major supplement to the current cotton insect management program. The beltwide eradication component would use the technology proven by the North Carolina trial and ongoing research. The eradication component remains essentially the same as in OPM-NI-BWE, but there are no provisions for additional staffing or funding of CES programs prior to, during, or following eradication.

OPM Technical Components

The "beltwide" OPM programs--OPM-I, OPM-PI, OPM-NI and OPM-NI-BWE--are an amalgam of 11 State programs, each of which reflects the unique combination of biological, environmental, and organizational factors affecting cotton insect control programs within each State. Each of these programs also consist of two insect management options--OPM and MOPM. Within these programs, the OPM option varies by the extent to which incentives are provided for area-wide diapause/pin-head square treatments.

The objective of the OPM option is to maintain the mid-season population of boll weevils below treatment levels prior to onset of Heliothis pressure. Corollary objectives are to assure effective levels of beneficial insects, acceptable levels of pesticide usage, and to maintain or improve yields.

Some of the technologies and practices to be used in implementing an OPM option are common among all States while others vary by State. Each State plan contains modifications as needed for implementation in that State (Attachment A). Key measures in an OPM option that are common to all States include population monitoring through scouting or field inspection, the use of traps for surveillance, and in-season boll weevil control based on State recommendations. Virtually 100 percent of the cotton acreage in weevil-infested areas would be scouted at least once a week in an organized OPM option.

A summary of differences in technical components for proposed State OPM options is provided in Table 1. Cotton States in the Southeast will generally require an average of three diapause control treatments on a high percentage of cotton acreage. This will effectively suppress boll weevil populations in the late summer and fall so that in-season insecticide treatments for boll weevil control would not be required prior to Heliothis pressure. In the Southwest, boll weevil suppression is commonly achieved by control of overwintered weevils with early-season insecticide treatments and with shorter-season or determinant varieties. Stalk destruction is voluntary in most areas but is mandatory in the Lower Rio Grande Valley of Texas. Recommended full and mid-season cotton varieties are recommended in the eastern States whereas the full range of varieties are recommended in Texas, depending on the particular region.

Table 1--Summary of Differences in Technical Components for Proposed OPM Program, by States and Production Regions 1/

State	2/ Regions	Cotton Varieties	3/ Treatments for Over-wintering Weevil Control	4/ Diapause Control		Stalk Destruction
				Acres Treated	Number Treatments	
			------No.-----	--%---	---No.----	
North Carolina	2,3,4	Full & Mid-Season	0	100	2.5-3.2	Voluntary
South Carolina	5,6	"	"	"	3.2-3.7	"
Georgia	7,8,9	"	As needed	"	3.2-3.7	"
Alabama	10,11	Full Season	"	0 100	0 2.2	"
Tennessee	12,13	Full & Mid-Season	0	51	3	"
Missouri	14	"	"	30	2.4	"
Mississippi	15,16, 17,18	Full Season	As needed	70-96	1.3-2.2	"
Arkansas	19,20	Full & Mid-Season	0	23-42	2.2-3.0	"
Louisiana	21,22	Full Season	"	96	2.0-2.3	"
Texas:						
Lower Rio	23	Full & Short Season	2.0-2.2	NA	NA	Mandatory
Lower Coastal Bend	24	Short Season	2.1	"	"	Voluntary
Upper Coastal Bend	25	"	2.0	42	1.9	"
Winter Garden	26	"	1.8	NA	NA	"
Central River Bottoms	27	Full & Short Season	1.6	"	"	"
Blacklands	28	Determinant	1.7	"	"	"
Rolling Plains	29	"	.7	25	2.4	"
Upper Concho	31	Determinant & Full Season	As needed	NA	NA	"
Oklahoma	34,35	"	"	23	2.0	"

1/ All State OPM plans include scouting at least once a week, traps for surveilance of boll weevil, and in-season boll weevil control based on State recommendations.

2/ For location of production regions, see Figure 1.

3/ Pinhead square treatments, based on Delphi estimates.

4/ Based on Delphi estimates for an effective OPM option. Modified Optimum Pest Management (MOPM) will not include organized, area-wide diapause control treatments for suppression of boll weevil populations.

In some regions of the cotton belt, especially the upper Mid-South, boll weevil populations are historically light and may not require control measures during most growing seasons. In these areas, the Modified Optimum Pest Management (MOPM) option would be implemented. Also, MOPM would be followed in areas heavily infested with boll weevils if the area-wide diapause technology could not be implemented.

A major cost component of all OPM programs is the personnel needed to carry out the respective program activities. Currently, 77 professional and technical insect management specialists are assigned to the CIC program. To effectively carry out the components of the beltwide OPM programs, an additional 173 persons would be required for a total of 250 cotton insect management specialists (Table 2-A, Attachment A).

BWE Technical Components

Boll weevil eradication is diapause-based, with organophosphorous insecticides as the major boll weevil suppression method. A detailed plan for beltwide eradication of the boll weevil is included in Attachment B. The sequence of activities within a given area covers 24 months. The period extends over one complete growing season plus parts of the previous (Fall) and part of the subsequent (Spring) seasons. A brief summary of program components by time-sequence of activities follows:

1. The Extension Services in the States involved would implement an information and education program so that growers know about program requirements and activities prior to program initiation. They would urge growers to voluntarily conduct a diapause program the previous fall. Also, the Extension Services would provide data on severity of the boll weevil problem.

2. APHIS program personnel would be on site in July.

3. Cotton fields in the Zone would be mapped in cooperation with ASCS and State agencies in July and early August.

4. Fall survey traps at 1 per 10 acres (at least 1 per field) would be serviced from August to November to further verify the severity of the boll weevil problem and to locate possible trouble spots.

5. Diapause treatments on all cotton acreage would begin in September after the regular season control program is completed by the grower, or before, if boll weevil populations are considered excessive. Insofar as possible, diapause control would be done during the harvest period. Treatment intervals would be 7-14 days, depending upon time of the year.

6. In areas where cotton harvest is normally completed before cotton plants are killed by cold weather, plant destruction by the grower would be required.

7. Diapause control would terminate when cotton plants are destroyed, either by cold weather or by the growers.

8. Spring traps at the rate of approximately one per acre would be placed around cotton fields of the previous season, oriented to potential hibernation sites. These traps would be serviced from one month before planting time until cotton begins to flower. This would be a period of about three months, during which new cotton fields of the current year would be mapped.

9. Where spring trap catches indicate a hazard of boll weevil population development in current cotton plantings, a series of four Dimilin treatments at weekly intervals followed by a Guthion cleanup treatment would be made. These treatments would begin before fruiting begins and would be done on an "as needed" basis. The Guthion cleanup treatment would be timed, insofar as possible, to not contribute to a potential Heliothis problem.

10. Sterile boll weevils would be dropped on all cotton at the rate of 100 per acre per week for four weeks beginning at about the 6-8 leaf stage of cotton growth.

11. After completion of the sterile insect drop, inseason pheromone traps at the rate of one per acre would be placed in the cotton fields. This trapping activity would continue until cotton begins to mature.

12. Traps would be removed from fields as cotton begins to mature and placed around field borders and serviced until November (approximately three months) for the fall survey.

13. If fall survey results indicate the presence of a potential over-wintering population, diapause treatments would be made on an "as needed" basis.

14. In the following spring, the spring survey around previous year cotton fields would be made through June 30.

15. On July 1, the survey operation would be turned over to the monitoring group and APHIS personnel would move to the next area scheduled for eradication.

16. In the event spot infestations of boll weevil persist or were found later, a special group would be formed to eliminate these populations. This group would be funded from the contingency portion of the operational budget.

PROGRAM PUBLIC COSTS

Public costs of implementing beltwide programs were estimated for each of 32 production regions in boll weevil-infested areas (Figure 1). OPMREEAC members estimated costs of beltwide CIC and OPM programs, while APHIS developed the beltwide BWE costs.

Cost Assumptions

The program cost summaries include all public (Federal and State) costs associated with each of the boll weevil/cotton insect management programs, including incentive payments to producers where applicable. Incentive payments for diapause and pin-head square treatments under the OPM program were based on Delphi estimates of farmers needs for such treatments. 2/ The costs of eradication includes the Federal, State and producer shares of eradication operations costs. All costs of eradication were estimated by APHIS. An evaluation of the costs to be shared by producers was made by the Economic Evaluation Team. 3/ All research and development costs were excluded because past investments are not relevant to the choice among current alternatives. Regular county Extension personnel are not included in these computations because their number is not likely to vary by the choice of insect management program. However, county Extension entomologists assigned specifically to cotton were included.

All cost estimates are in constant 1979 dollars. No forecasts were made for changes in price levels during the implementation period, nor for changes in relative price levels of different inputs. Technology was assumed to be unchanged from existing on-the-shelf procedures for the evaluation period. It was felt that analysis of changes in relative prices and potential advances in technology, limitations on use, or other loss of effective technology would have unduly complicated the effort.

Total Public Funding

The pattern of public costs for each of the beltwide programs varies considerably from initiation through full implementation, (Table 2 and Figure 2). CIC, the baseline program, is currently costing about $2.5 million annually and it would continue at that rate.

2/ See "The Delphi--Insecticide Use and Lint Yields", ESS Staff Report No. AGESS810507, May 1981, for a documentation of the procedures used to estimate diapause and pin-head square treatments.

3/ The economic evaluation was based on an assumption that producers would pay 50 percent of eradication operating costs. Alternative cost-shares were also evaluated.

Table 2--Annual public costs for beltwide boll weevil/cotton insect management programs 1/

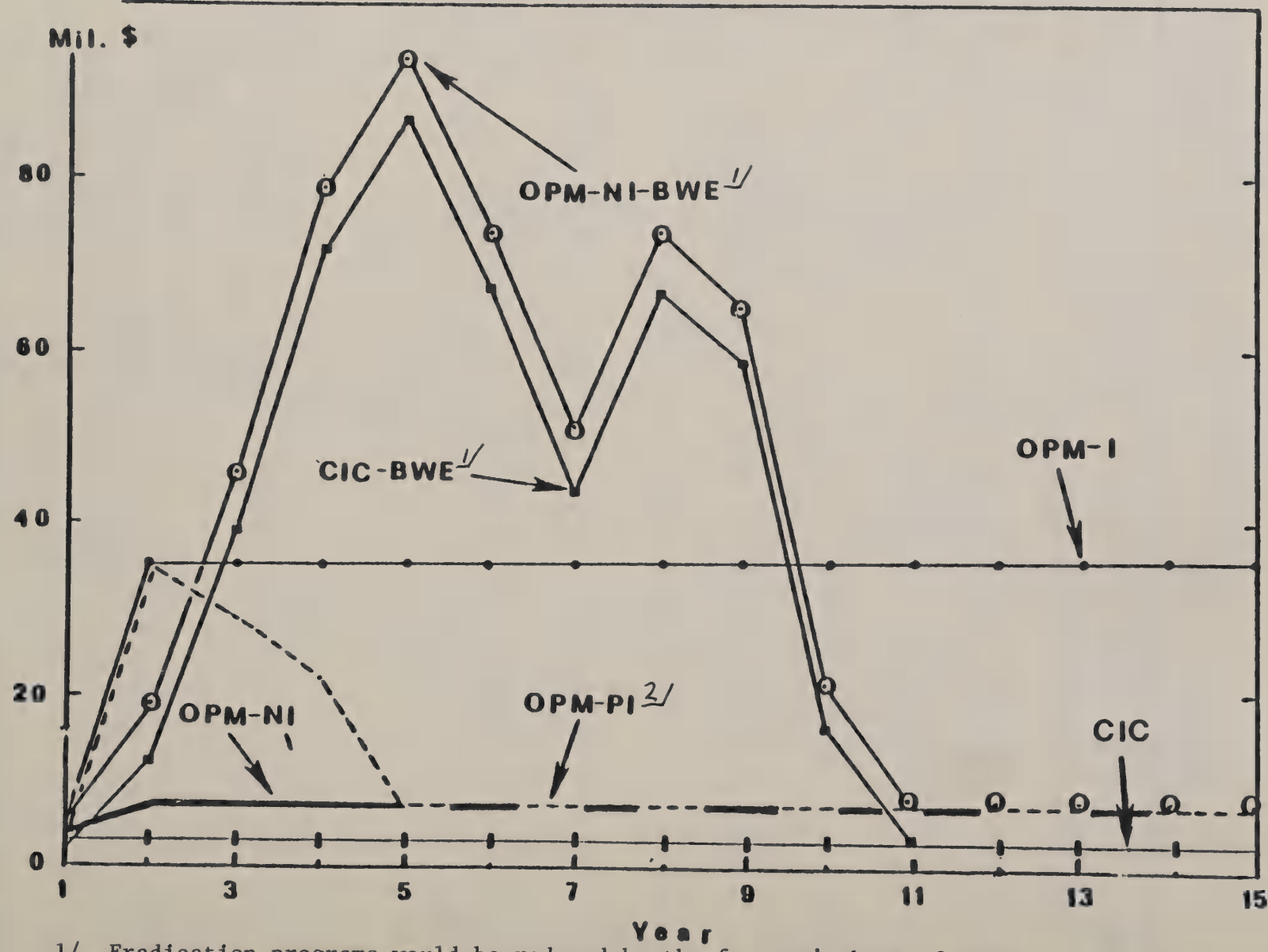
Year	CIC	OPM-I	OPM-PI	OPM-NI	OPM-NI-BWE 2/	CIC-BWE 2/
	Million dollars 3/					
1	2.5	5.6	5.5	4.7	6.2	2.5
2	"	35.8	35.6	6.9	19.1	12.1
3	"	"	28.9	"	46.2	39.2
4	"	"	22.1	"	79.5	72.5
5	"	"	6.9	"	94.3	87.3
6	"	"	"	"	74.0	67.1
7	"	"	"	"	51.0	44.1
8	"	"	"	"	74.1	67.2
9	"	"	"	"	65.4	59.3
10	"	"	"	"	21.1	16.0
11	"	"	"	"	7.7	3.3
12	"	"	"	"	7.5	3.1
13	"	"	"	"	"	"
14	"	"	"	"	"	"
15	2.5	35.8	6.9	6.9	7.5	3.1

1/ The six programs are: CIC (Current Insect Control); OPM-I (Optimum Pest Management with Incentives); OPM-PI (Optimum Pest Management with Phased Incentives) OPM-NI (Optimum Pest Management with No Incentives); OPM-NI-BWE (Optimum Pest Management with No Incentives and with Boll Weevil Eradication); and CIC-BWE (Current Insect Control with Boll Weevil Eradication).

2/ Includes all eradication program costs as well as related OPM-NI and followup monitoring costs. Public costs would be lower than these amounts if farmers share some of the eradication costs.

3/ Assumes constant 1979 dollars and constant 1974-1978 average acreage.

PUBLIC COSTS FOR BELTWIDE PROGRAMS



1/ Eradication programs would be reduced by the farmers' share of cost.

2/ OPM-PI identical to OPM-I in years 1 and 2, and identical to OPM-NI in year 5 and thereafter.

The funding for the OPM-I program with continuing incentive payments would increase from about $6 million the first year to $36 million by the second year and remain at that level. The cost for OPM-PI would be similar to OPM-I during the first two years but would decline to $7 million by the fifth year. The OPM-NI program costs would increase to $7 million by the second year and continue at that rate. Compared with OPM-NI, about $1 million more would be needed under the OPM phased and full incentives programs during the first year to prepare producers for the areawide diapause strategy.

With the eradication programs, OPM-NI-BWE and CIC-BWE, the costs rise to $94 and $87 million respectively, in the fifth year and decline to $8 and $3 million by the twelfth and subsequent years depending on whether the OPM or CIC Extension support is provided. It would cost an estimated $460 million, including capital investments, during the 9 years to eradicate the boll weevil. If farmers share part of the eradication costs, public expenditures under the latter two programs would be reduced.

The CIC and three incentive related OPM programs would be funded through CES while the eradication programs, OPM-NI-BWE and CIC-BWE, would be jointly funded by CES and APHIS.

Public Cost Estimates by Programs, States and Regions

Current Insect Control (CIC)

The CIC program is the benchmark against which other programs are compared in the beltwide analysis. The cotton acreage in the weevil-infested regions averaged 7.2 million acres during 1974-78. No alternative insect management programs were specified for the weevil-free States of California, Arizona, and New Mexico, or the Texas High Plains and two other West Texas regions. However, the impacts (spinoffs) of alternative programs in weevil-infested areas are evaluated for all major regions, including the Far West.

The Cooperative Extension Service costs for CIC were estimated to be $2.5 million annually. If this program were selected as the best beltwide boll weevil/cotton insect management program, the real costs would continue at that level during the evaluation period as shown in Table 3 and Figure 2. The CIC costs averaged 35 cents per acre beltwide and varied widely by State from 12 cents per acre in Arkansas to 83 cents per acre in North Carolina. These costs depend on many factors, some of which include the relative importance of cotton, the geographic and climatic location of the production area, intensity of production and intensity of insect infestation. The public costs for a particular production region were as high as $3.89 per acre in the Winter Garden area of Texas for its 20 thousand acres. Only two other production regions exhibited public costs over one dollar per acre. They were Northeast Mississippi and the Upper Concho area of Texas.

Optimum Pest Management

Cost estimates were developed for three beltwide Optimum Pest Management Programs that would be administered and funded by the Cooperative Extension Service. These programs differ chiefly on the extent to which farmers would be expected to share the costs of diapause/pinhead square treatments and on the extent to which producers would likely participate in an organized areawide program.

In the program having the lowest public cost (OPM-NI), farmers would bear the entire cost of diapause/pinhead square treatments. In the medium public cost program (OPM-PI), farmers would pay the entire cost after an initial learning period. The rationale for phasing out payments is that the profitability of diapause and/or pinhead square treatments would be demonstrated during the first few years and that growers or grower organizations would continue their support of proven practices. In the highest public cost program (OPM-I), farmers would be reimbursed from public funds for all diapause and pinhead square treatments.

A common attribute of all OPM programs is that additional Extension personnel and support are required to provide technical assistance and educational guidance in managing boll weevils as well as other cotton insects. An effective diapause and pinhead square strategy would be used wherever farmer acceptance was likely to maintain mid-season population of boll weevils below in-season treatment levels on 90 percent or more of the acreage prior to onset of Heliothis pressure.

The OPM-I program was tested in the Panola County, Mississippi trial during 1978-80. The costs for a beltwide program of the type used in the trial area and two other synthesized programs are analyzed below. The differences in program performance are developed in the Delphi report on insecticide use and lint yields. 4/

Full Incentives (OPM-I). It was estimated that two years would be required to hire the 173 entomologists and technicians needed to carry out the OPM-I program (Table 2-A, Attachment A). During the first year of program transition, no incentives would be offered because there would not be sufficient technical assistance to achieve success. Thus, the first year costs of $5.6 million represents only personnel and support costs (Table 4). Incentive payments in the second year and thereafter of $27 million are based on expected treatments by farmers and costs of treatments as developed by the Delphi panel of knowledgeable experts. 4/ Total annual costs are estimated at $36 million for the second and subsequent years of the program. If this program were selected as the best beltwide boll weevil program, it is assumed that the real costs would continue at $4.94 per acre.

The costs of Extension personnel and incentive payments range from 99 cents per acre in the Limestone Valley area of Alabama, where diapause and pinhead square treatments are not needed, to about $13 per acre throughout Georgia and South Carolina (Table 4). Program costs in North Carolina would total over $10 per acre and the Upper Bend and Winter Garden areas of Texas would cost over $11 per acre for both technical assistance and farmer incentives. These incentive payments vary widely because of differences in acreage treated and numbers of diapause and pinhead square treatments.

4/ The Delphi--Insecticide Use and Lint Yields, ESS Staff Report No. AGESS810504.

Phased Incentives (OPM-PI). The Cooperative Extension costs for an OPM-PI program would expand for the first two years in the same manner as the OPM-I program (Table 5 and Figure 2). However, it would decline to about $7 million in the fifth year as producers would pay for diapause and pinhead square treatments after incentive payments have been phased out. Thus, this program would maintain the real increase in Extension personnel during the evaluation period at an annual cost of $4.5 million above current levels.

OPM-PI program costs, after implementation, would average 96 cents per acre beltwide and range from 40 cents per acre in Oklahoma to $4.24 per acre in the Winter Garden area of Texas (Table 5). This increase represents a 266 percent rise from CIC in Oklahoma but only a 9 percent rise in the Winter Garden area. Such wide differences in additional resources not only reflect differences in current (CIC) levels of CES activity, but also the rather "lumpy" technical resources and opportunities for achieving economies of scale in delivering information.

No Incentives (OPM-NI). The Cooperative Extension costs for an OPM-NI program would expand in the first year from the current level of $2.5 million to $4.7 million and then $6.9 million thereafter, or about 95 cents per acre (Table 6 and Figure 2). The State average costs for OPM-NI varied from 42 cents per acre in Missouri to $1.95 per acre in South Carolina. Most of the State entomologists estimated the need for professional and technical personnel for the State as a whole rather than at the regional level, which accounts for regional costs being identical in some States. Of the $6.9 million Optimum Pest Management effort beltwide in weevil-infested areas, over $2 million would be used in Texas and nearly $1.6 million in Mississippi. In most other States, cotton acreage is sufficiently small such that expenditures would generally be less than $500 thousand per State.

Boll Weevil Eradication

Cost estimates were developed for two beltwide programs in weevil infested areas that included eradication of the boll weevil as a major control strategy--OPM-NI-BWE and CIC-BWE. The programs differ in the extent of Extension support prior to, during and following eradication. The programs would be administered jointly by APHIS and CES.

The CES component of the two eradication programs would be in place prior to the initiation of eradication. The increased extension effort of OPM-NI-BWE would be expected to achieve the optimum pest management objectives similar to OPM-NI prior to eradication in each zone. These monies are expected to substantially improve farmers' preparation for the eradication effort during the two or more years that it is operating in their zone. After eradication, the increased cadre of State entomologists would redirect their efforts towards the optimum management of cotton insects in the absence of the boll weevil.

Extension activities under the CIC-BWE program are similar to those in CIC, since no additional Extension funding is provided. It would be expected that the entomologists would prepare farmers for the upcoming eradication effort as much as they could within the budget constraint. After the boll weevil is eliminated, the State entomologists would have more time to spend on other cotton insect pests. Eradication would be completed in a given area in two years. However, since it is impossible to implement eradication beltwide at one time, eight zones were delineated so that eradication would be completed beltwide in nine years. Detailed procedures of beltwide eradication and estimated costs by regions are shown in Attachment B.

Following eradication, APHIS will monitor for the boll weevil on a diminishing basis. Monitoring costs diminish from the first through third year after eradication, as the trapping intensity declines from 1 per 20 acres to 1 per 200 acres.

Monitoring at an average rate of one trap per 200 acres would enable program flexibility to trap at higher rates in more susceptible areas and less in more secure areas. The relatively short natural migration distance of boll weevils and the high degree of effectiveness with existing traps is expected to keep monitoring costs low. Furthermore, no contingency monies were budgeted to remove reinfestations since the areas are likely to be delimited quickly.

The costs of eradication are not expected to vary due to the level of Extension resources, even though the final performance is likely to differ in terms of insecticide use and yields. The additional CES support associated with OPM-NI-BWE would have a major impact on the management of cotton insects in the absence of boll weevil rather than influence the costs of eradication.

Increased Extension Effort and Eradication (OPM-NI-BWE). Extension (OPM) costs during eradication would range up to $9.5 million annually, then drop to about $6.9 million annually thereafter (Table 7). Annual eradication costs are above $35 million nationally for seven years and up to $84 million by the fifth year of the beltwide APHIS effort. Eradication (BWE) operation costs total about $440 million over a nine year period. Capital investment costs for eradication total $20 million over eight years. The monitoring program levels off at about $590 thousand per year by the thirteenth year and continues indefinitely.

Public costs of eradication would be lower than $440 million depending on the producer and other non-federal shares to be determined. Monitoring and OPM costs are public costs.

The time-stream of program costs by regions is shown in Table 8. No eradication (BWE) costs are shown for region #2 in North Carolina as that is the weevil-free area in North Carolina where the Eradication Trial was conducted in 1978-80. Also, it is assumed that no eradication effort is needed in Missouri after weevils are eradicated in adjacent areas from which migratory flights occur.

Current Extension Effort and Eradication (CIC-BWE). Extension costs in this program remain at the CIC level of $2.5 million annually. However, all other public costs, including eradication and monitoring costs, are the same as for OPM-NI-BWE (Tables 9 and 10). Successful eradication is assumed in both programs.

Table 3--Current Insect Control (CIC) Program Annual Costs, by Region and State 1/

State and Region	Total Cost	Total Acres 2/	Cost Per Acre
	----$1,000----	--1,000 Acres--	---Dollars--
North Carolina (Total)	50	60	.83
North (2)	19	23	.83
South (3)	27	32	.83
Piedmont (4)	4	5	.83
South Carolina (Total)	101	176	.57
Coastal Plains (5)	89	156	.57
Piedmont (6)	11	19	.57
Georgia (Total)	123	229	.54
Piedmont (7)	14	25	.54
East (8)	50	93	.54
Southwest (9)	60	111	.54
Alabama (Total)	167	448	.37
Limestone Valley (10)	99	264	.37
South (11)	68	183	.37
Tennessee (Total)	78	342	.23
North Br. Loam (12)	60	265	.23
South Br. Loam (13)	18	78	.23
Missouri (14)	54	281	.19
Mississippi (Total)	512	1,401	.37
Northeast (15)	146	95	1.55
North Central (16)	139	201	.69
Delta (17)	114	896	.13
South (18)	112	209	.54
Arkansas (Total)	115	931	.12
Northeast (19)	57	458	.12
Southeast (20)	57	472	.12
Louisiana (Total)	152	512	.30
Northeast (21)	129	435	.30
Red River Valley (22)	23	78	.30
Texas (Total)	1,081	2,381	.45
Lower Rio Grande (23)	121	279	.43
Lower Bend (24)	118	119	.99
Upper Bend (25)	76	90	.84
Winter Garden (26)	79	20	3.89
Central River Bottom (27)	43	48	.90
Blacklands (28)	278	484	.57
Rolling Plains (29)	211	1,208	.17
Upper Concho (31)	155	132	1.18
Oklahoma (Total)	73	482	.15
North (34)	37	243	.15
South (35)	36	239	.15
11 States Total	2,504	7,243	.35

The sum of individual regions may not add to total because of rounding.

1/ Includes Federal and State funding of cotton insect management programs excluding county personnel not specifically identified as cotton entomologists. Excludes all costs paid by producers. All estimates are for weevil-infested areas.

2/ Average 1974-78 cotton acreage.

Table 4--Optimum Pest Management with Continuing Full Incentives (OPM-I) Program Annual Costs, by Region and State 1/

State and Region	Year 1		Year 2	
	Total Cost	Cost Per Acre	Total Cost	Cost Per Acre
	--$1,000---	----Dollars---	--$1,000---	----Dollars---
North Carolina:				
North (2)				
General	25	1.10	32	1.37
Diapause	---	---	186	8.08
Total	25	1.10	218	9.45
South (3)				
General	35	1.10	44	1.37
Diapause	---	---	284	8.88
Total	35	1.10	328	10.24
Piedmont (4)				
General	5	1.10	7	1.37
Diapause	---	---	53	10.58
Total	5	1.10	60	11.96
State Totals				
General	66	1.10	82	1.37
Diapause	---	---	523	8.72
Total	66	1.10	605	10.08
South Carolina:				
Coastal Plain (5)				
General	197	1.26	305	1.95
Diapause	---	---	1,731	11.06
Total	197	1.26	2,036	13.01
Piedmont (6)				
General	24	1.26	38	1.95
Diapause	---	---	204	10.58
Total	24	1.26	242	12.54
State Total				
General	222	1.26	343	1.95
Diapause	---	---	1,935	11.01
Total	222	1.26	2,278	12.96

Continued----------

Table 4--Optimum Pest Management with Continuing Full Incentives (OPM-I) Program Annual Costs, by Region and State 1/ (Continued)

State and Region	Year 1		Year 2	
	Total Cost	Cost Per Acre	Total Cost	Cost Per Acre
	--$1,000---	---Dollars----	--$1,000---	---Dollars----
Georgia:				
Piedmont (7)				
General	24	.97	35	1.40
Diapause	---	---	268	10.59
Total	24	.97	303	11.99
East (8)				
General	90	.97	130	1.40
Diapause	---	---	1,104	11.92
Total	90	.97	1,234	13.32
Southwest (9)				
General	108	.97	156	1.40
Diapause	---	---	1,367	12.30
Total	108	.97	1,523	13.71
State Totals				
General	222	.97	321	1.40
Diapause	---	---	2,739	11.96
Total	222	.97	3,060	13.36
Alabama:				
Limestone V. (10)				
General	180	.68	261	.99
Diapause (N/A)	---	---	---	---
Total	180	.68	261	.99
South (11)				
General	125	.68	181	.99
Diapause	---	---	1,232	6.72
Total	125	.68	1,414	7.71
State Totals				
General	305	.68	443	.99
Diapause	---	---	1,232	2.75
Total	305	.68	1,675	3.74

Continued----------

Table 4--Optimum Pest Management with Continuing Full Incentives (OPM-I) Program Annual Costs, by Region and State 1/ (Continued)

State and Region	Year 1		Year 2	
	Total Cost	Cost Per Acre	Total Cost	Cost Per Acre
	--$1,000---	---Dollars----	--$1,000---	---Dollars----
Tennessee: (12, 13)				
General	156	.46	235	.68
Diapause	---	---	1,582	4.62
Total	156	.46	1,817	5.30
Missouri: (14)				
General	172	.61	291	1.04
Diapause	---	---	576	2.05
Total	172	.61	867	3.09
Mississippi:				
Northeast (15)				
General	197	2.08	248	2.62
Diapause	---	---	398	4.20
Total	197	2.08	646	3.82
North Central (16)				
General	247	1.22	354	1.76
Diapause	---	---	901	4.47
Total	247	1.22	1,255	6.23
Delta (17)				
General	345	.39	577	.64
Diapause	---	---	2,213	2.47
Total	345	.39	2,790	3.11
Southern (18)				
General	274	1.31	436	2.09
Diapause	---	---	1,195	5.73
Total	274	1.31	1,631	7.82
State Totals				
General	1,063	.76	1,615	1.15
Diapause	---	---	4,707	3.36
Total	1,063	.76	6,322	4.51

Continued----------

Table 4--Optimum Pest Management with Continuing Full Incentives (OPM-I) Program Annual Costs, by Region and State 1/ (Continued)

State and Region	Year 1		Year 2	
	Total Cost	Cost Per Acre	Total Cost	Cost Per Acre
	--$1,000---	---Dollars----	--$1,000---	---Dollars----
Arkansas:				
Northeast (19)				
General	308	.67	558	1.22
Diapause	---	---	477	1.04
Total	308	.67	1,035	2.26
Southeast (20)				
General	271	.57	484	1.03
Diapause	---	---	1,275	2.70
Total	271	.57	1,759	3.72
State Totals				
General	579	.62	1,043	1.12
Diapause	---	---	1,752	1.88
Total	579	.62	2,795	3.00
Louisiana:				
Northeast (21)				
General	326	.75	523	1.20
Diapause	---	---	3,182	7.32
Total	326	.75	3,705	8.52
Red River Valley (22)				
General	58	.75	93	1.20
Diapause	---	---	499	6.43
Total	58	.75	592	7.63
State Totals				
General	384	.75	616	1.20
Diapause	---	---	3,681	7.19
Total	384	.75	4,297	8.39
Texas:				
Lower Rio Grande (23)				
General	437	1.57	753	2.70
O-W Mgt.	---	---	1,257	4.51
Total	437	1.57	2,010	7.21

Continued----------

Table 4--Optimum Pest Management with Continuing Full Incentives (OPM-I) Program Annual Costs, by Region and State 1/ (Continued)

State and Region	Year 1		Year 2	
	Total Cost	Cost Per Acre	Total Cost	Cost Per Acre
	--$1,000---	---Dollars----	--$1,000---	---Dollars----
Texas: (Continued				
Lower Bend (24)				
General	236	1.99	354	2.98
O-W Mgt.	---	---	695	5.85
Total	236	1.99	1,049	8.83
Upper Bend (25)				
General	151	1.69	227	2.53
Diapause/O-W Mgt.	---	---	783	8.73
Total	151	1.69	1,010	11.27
Winter Garden (26)				
General	102	4.99	124	6.09
O-W Mgt.	---	---	109	5.36
Total	102	4.99	233	11.41
C. River Bottoms (27)				
General	71	1.48	98	2.06
O-W Mgt.	---	---	128	2.67
Total	71	1.48	226	4.73
Blacklands (28)				
General	466	.96	654	1.35
O-W Mgt.	---	---	1,327	2.74
Total	466	.96	1,981	4.09
Rolling Plains (29)				
General	674	.56	1,136	.94
O-W Mgt.	---	---	3,178	2.63
Total	674	.56	4,314	3.57
Upper Concho (31)				
General	160	1.21	165	1.25
Total	160	1.21	165	1.25
State Totals				
General	2,297	.96	3,512	1.48
Diapause/O-W Mgt.	---	---	7,477	3.14
Totals	2,297	.96	10,989	4.62

Continued----------

Table 4--Optimum Pest Management with Continuing Full Incentives (OPM-I) Program Annual Costs, by Region and State 1/ (Continued)

State and Region	Year 1		Year 2	
	Total Cost	Cost Per Acre	Total Cost	Cost Per Acre
	--$1,000---	---Dollars----	--$1,000---	---Dollars----
Oklahoma: (34, 35)				
General	134	.28	195	0.40
Diapause (N/A)	---	---	904	1.88
Total	134	.28	1,099	2.28
11 States:				
General	5,599	.77	8,695	1.20
Diapause/O-W Mgt.	---	---	27,108	3.74
Total	5,599	.77	35,803	4.94

The sum of individual regions may not add to total because of rounding.

1/ It will take up to 2 years to fully implement the OPM-I program; thus, year 2 costs reflect full implementation. An estimated 50 percent of personnel and other resources will be in place during year 1, depending on lead time for hiring and other commitments.

Table 5--Optimum Pest Management with Phased Incentives (OPM-PI) Program Annual Costs, by Region and State 1/

State and Region	Year 1		Year 2		Year 3		Year 4		Year 5 +	
	Total Cost	Cost Per Acre	Total Cost	Cost Per Acre	Total Cost	Cost Per Acre	Total Cost	Cost Per Acre	Total Cost	Cost Per Acre
	$1,000	Dol.	$1,000	Dol.	$1,000	Dol.	$1,000	Dol.	$1,000	Dol.
North Carolina:										
North (2)										
General Cost	25	1.10	32	1.37	32	1.37	32	1.37	32	1.37
Diapause	---	---	186	8.08	139	6.04	93	4.02	---	---
Total	25	1.10	218	9.45	170	7.41	124	5.40	32	1.37
South (3)										
General Cost	35	1.10	44	1.37	44	1.37	44	1.37	44	1.37
Diapause	---	---	284	8.88	213	6.65	142	4.43	---	---
Total	35	1.10	328	10.24	257	8.02	186	5.80	44	1.37
Piedmont (4)										
General Cost	5	1.10	7	1.37	7	1.37	7	1.37	7	1.37
Diapause	---	---	53	10.58	40	7.94	26	5.30	---	---
Total	5	1.10	60	11.96	47	9.31	33	6.67	7	1.37
State Total										
General Cost	66	1.10	82	1.37	82	1.37	82	1.37	82	1.37
Diapause	---	---	523	8.72	391	6.52	261	4.35	---	---
Total	66	1.10	605	10.08	473	7.89	343	5.72	82	1.37
South Carolina:										
Coastal Plains (5)										
General Cost	197	1.26	305	1.95	305	1.95	305	1.95	305	1.95
Diapause	---	---	1,731	11.06	1,298	8.30	865	5.53	---	---
Total	197	1.26	2,036	13.01	1,603	10.25	1,170	7.48	305	1.95
Piedmont (6)										
General	24	1.26	38	1.95	38	1.95	38	1.95	38	1.95
Diapause	---	---	204	10.58	153	7.94	102	5.30	---	---
Total	24	1.26	242	12.54	191	9.91	140	7.26	38	1.95

Continued----------

Table 5--Optimum Pest Management with Phased Incentives (OPM-PI) Program Annual Costs, by Region and State 1/(Contd.)

State and Region	Year 1		Year 2		Year 3		Year 4		Year 5 +	
	Total Cost	Cost Per Acre	Total Cost	Cost Per Acre	Total Cost	Cost Per Acre	Total Cost	Cost Per Acre	Total Cost	Cost Per Acre
	$1,000	Dol.	$1,000	Dol.	$1,000	Dol.	$1,000	Dol.	$1,000	Dol.
South Carolina: (Continued)										
State Total										
General	222	1.26	343	1.95	343	1.95	343	1.95	343	1.95
Diapause	---	---	1,935	11.01	1,451	8.26	968	5.50	---	---
Total	222	1.26	2,278	12.96	1,794	10.21	1,311	7.45	343	1.95
Georgia:										
Piedmont (7)										
General	24	.97	35	1.40	35	1.40	35	1.40	35	1.40
Diapause	---	---	268	10.59	201	7.94	134	5.30	---	---
Total	24	.97	303	11.99	236	9.34	169	6.70	35	1.40
East (8)										
General	90	.97	130	1.40	130	1.40	130	1.40	130	1.40
Diapause	---	---	1,104	11.92	828	8.94	552	5.96	---	---
Total	90	.97	1,234	13.32	958	10.34	682	7.36	130	1.40
Southwest (9)										
General	108	.97	156	1.40	156	1.40	156	1.40	156	1.40
Diapause	---	---	1,367	12.30	1,025	9.23	684	6.16	---	---
Total	108	.97	1,523	13.71	1,181	10.63	840	7.56	156	1.40
State Total										
General	222	.97	321	1.40	321	1.40	321	1.40	321	1.40
Diapause	---	---	2,739	11.96	2,054	8.97	1,370	5.98	---	---
Total	222	.97	3,060	13.36	2,375	10.37	1,691	7.38	321	1.40

Continued----------

Table 5--Optimum Pest Management with Phased Incentives (OPM-PI) Program Annual Costs, by Region and State 1/(Contd.)

State and Region	Year 1		Year 2		Year 3		Year 4		Year 5 +	
	Total Cost	Cost Per Acre	Total Cost	Cost Per Acre	Total Cost	Cost Per Acre	Total Cost	Cost Per Acre	Total Cost	Cost Per Acre
	$1,000	Dol.	$1,000	Dol.	$1,000	Dol.	$1,000	Dol.	$1,000	Dol.
Alabama:										
Limestone Valley (10)										
General	180	.68	261	.99	261	.99	261	.99	261	.99
Diapause (N.A.)	---	---	---	---	---	---	---	---	---	---
Total	180	.68	261	.99	261	.99	261	.99	261	.99
South (11)										
General	125	.68	181	.99	181	.99	181	.99	181	.99
Diapause	---	---	1,232	6.72	924	5.04	616	3.36	---	---
Total	125	.68	1,414	7.71	1,106	6.03	798	4.35	181	.99
State Total										
General	305	.68	443	.99	443	.99	443	.99	443	.99
Diapause	---	---	1,232	2.75	924	2.06	616	1.38	---	---
Total	305	.68	1,675	3.74	1,367	3.05	1,059	2.37	443	.99
Tennessee: (12, 13)										
General	156	.46	235	.68	235	.68	235	.68	235	.68
Diapause	---	---	1,582	4.62	1,187	3.47	791	2.31	---	---
Total	156	.46	1,817	5.30	1,422	4.15	1,026	3.00	235	.68
Missouri: (14)										
General	172	.61	291	1.04	291	1.04	291	1.04	117	.42
Diapause	---	---	576	2.05	432	1.54	288	1.02	---	---
Total	172	.61	867	3.09	723	2.57	579	2.06	117	.42

Continued----------

Table 5--Optimum Pest Management with Phased Incentives (OPM-PI) Program Annual Costs, by Region and State 1/(Contd.)

State and Region	Year 1		Year 2		Year 3		Year 4		Year 5 +	
	Total Cost	Cost Per Acre	Total Cost	Cost Per Acre	Total Cost	Cost Per Acre	Total Cost	Cost Per Acre	Total Cost	Cost Per Acre
	$1,000	Dol.	$1,000	Dol.	$1,000	Dol.	$1,000	Dol.	$1,000	Dol.
Mississippi:										
Northeast (15)										
General	197	2.08	248	2.62	248	2.62	248	2.62	248	2.62
Diapause	---	---	398	4.20	298	3.14	199	2.10	---	---
Total	197	2.08	646	6.82	546	5.76	448	4.72	248	2.62
North Central (16)										
General	247	1.22	354	1.76	354	1.76	354	1.76	354	1.76
Diapause	---	---	901	4.47	675	3.35	450	2.24	---	---
Total	247	1.22	1,255	6.23	1,030	5.11	805	3.99	354	1.76
Delta (17)										
General	346	.39	577	.64	577	.64	577	.64	577	.64
Diapause	---	---	2,213	2.47	1,660	1.85	1,106	1.23	---	---
Total	346	.39	2,790	3.11	2,237	2.49	1,683	1.87	577	.64
Southern (18)										
General	273	1.31	433	2.08	433	2.08	433	2.08	433	2.08
Diapause	---	---	1,195	5.73	896	4.30	598	2.86	---	---
Total	273	1.31	1,631	7.82	1,330	6.37	1,031	4.94	433	2.08
State Totals										
General	1,062	.76	1,613	1.15	1,613	1.15	1,613	1.15	1,613	1.15
Diapause	---	---	4,707	3.36	3,530	2.52	2,354	1.68	---	---
Total	1,062	.76	6,320	4.51	5,143	3.67	3,967	2.83	1,613	1.15

Continued----------

Table 5--Optimum Pest Management with Phased Incentives (OPM-PI) Program Annual Costs, by Region and State 1/(Contd.)

State and Region	Year 1		Year 2		Year 3		Year 4		Year 5 +	
	Total Cost	Cost Per Acre	Total Cost	Cost Per Acre	Total Cost	Cost Per Acre	Total Cost	Cost Per Acre	Total Cost	Cost Per Acre
	$1,000	Dol.	$1,000	Dol.	$1,000	Dol.	$1,000	Dol.	$1,000	Dol.
Arkansas:										
Northeast (19)										
General	308	.67	559	1.22	559	1.22	559	1.22	464	1.01
Diapause	---	---	477	1.04	358	.78	238	.52	---	---
Total	308	.67	1,035	2.26	917	2.00	797	1.74	464	1.01
Southeast (20)										
General	271	.57	485	1.03	485	1.03	485	1.03	380	.80
Diapause	---	---	1,275	2.70	956	2.02	638	1.35	---	---
Total	271	.57	1,759	3.72	1,441	3.05	1,123	2.38	380	.80
State Total										
General	579	.62	1,043	1.12	1,043	1.12	1,043	1.12	843	.91
Diapause	---	---	1,752	1.88	1,314	1.41	876	.94	---	---
Total	579	.62	2,795	3.00	2,357	2.53	1,919	2.06	843	.91
Louisiana:										
Northeast (21)										
General	326	.75	523	1.20	523	1.20	523	1.20	523	1.20
Diapause	---	---	3,182	7.32	2,387	5.49	1,591	3.66	---	---
Total	326	.75	3,705	8.52	2,910	6.69	2,114	4.86	523	1.20
Red River Valley (22)										
General	58	.75	93	1.20	93	1.20	93	1.20	93	1.20
Diapause	---	---	499	6.43	374	4.82	249	3.21	---	---
Total	58	.75	592	7.63	467	6.02	342	4.41	93	1.20
State Total										
General	384	.75	616	1.20	616	1.20	616	1.20	616	1.20
Diapause	---	---	3,681	7.19	2,761	5.39	1,840	3.59	---	---
Total	384	.75	4,297	8.39	3,377	6.59	2,456	4.79	616	1.20

Continued----------

Table 5--Optimum Pest Management with Phased Incentives (OPM-PI) Program Annual Costs, by Region and State 1/(Contd.)

State and Region	Year 1		Year 2		Year 3		Year 4		Year 5 +	
	Total Cost	Cost Per Acre	Total Cost	Cost Per Acre	Total Cost	Cost Per Acre	Total Cost	Cost Per Acre	Total Cost	Cost Per Acre
	$1,000	Dol.	$1,000	Dol.	$1,000	Dol.	$1,000	Dol.	$1,000	Dol.
Texas:										
Lower Rio Grande (23)										
General	431	1.55	742	2.66	742	2.66	742	2.66	262	.94
O-W Management	---	---	1,257	4.51	943	3.38	629	2.26	---	---
Total	431	1.55	1,999	7.17	1,685	6.04	1,370	4.92	262	.94
Lower Bend (24)										
General	234	1.97	349	2.94	349	2.94	349	2.94	202	1.70
O-W Management	---	---	695	5.85	521	4.38	348	2.93	---	---
Total	234	1.97	1,044	8.79	870	7.32	697	5.86	202	1.70
Upper Bend (25)										
General	149	1.67	223	2.49	223	2.49	223	2.49	149	1.66
Diapause/O-W	---	---	783	8.73	587	6.55	392	4.37	---	---
Total	149	1.67	1,006	11.22	810	9.04	615	6.86	149	1.66
Winter Garden (26)										
General	101	4.97	124	6.05	124	6.05	124	6.05	87	4.24
O-W Management	---	---	109	5.36	82	4.02	54	2.64	---	---
Total	101	4.97	233	11.41	206	10.07	178	8.69	87	4.24
C. River Bottom (27)										
General	70	1.46	97	2.02	97	2.02	97	2.02	54	1.14
O-W Management	---	---	128	2.67	96	2.01	64	1.34	---	---
Total	70	1.46	225	4.69	193	4.04	161	3.37	54	1.14
Blacklands (28)										
General	417	.86	577	1.15	557	1.15	557	1.15	523	1.08
O-W Management	---	---	1,327	2.74	1,995	2.05	664	1.37	---	---
Total	417	.86	1,904	3.89	1,552	3.20	1,221	2.52	523	1.08

Continued----------

Table 5--Optimum Pest Management with Phased Incentives (OPM-PI) Program Annual Costs, by Region and State 1/(Contd.)

State and Region	Year 1		Year 2		Year 3		Year 4		Year 5 +	
	Total Cost	Cost Per Acre	Total Cost	Cost Per Acre	Total Cost	Cost Per Acre	Total Cost	Cost Per Acre	Total Cost	Cost Per Acre
	$1,000	Dol.	$1,000	Dol.	$1,000	Dol.	$1,000	Dol.	$1,000	dol.
Texas: (Continued)										
Rolling Plains (29)										
General	649	.54	1,088	.90	1,088	.90	1,088	.90	677	.56
Diapause/O-W	---	---	3,178	2.63	2,384	1.97	1,589	1.32	---	---
Total	649	.54	4,266	3.53	3,472	2.87	2,677	2.22	677	.56
Upper Concho (31)										
General	160	1.21	165	1.25	165	1.25	165	1.25	165	1.25
Diapause (N.A.)	---	---	---	---	---	---	---	---	---	---
Total	160	1.21	165	1.25	165	1.25	165	1.25	165	1.25
State Totals										
General	2,213	.93	3,344	1.40	3,344	1.40	3,344	1.40	2,119	.89
Diapause (N.A.)	---	---	7,477	3.14	5,608	2.36	3,738	1.57	---	---
Total	2,213	.93	10,821	4.54	8,952	3.76	7,082	2.97	2,119	.89
Oklahoma: (34, 35)										
General	134	.28	195	.40	195	.40	195	.40	195	.40
Diapause (N.A.)	---	---	904	1.88	678	1.41	452	.94	---	---
Total	134	.28	1,099	2.28	873	1.81	647	1.34	195	.40
11 States										
General	5,514	.76	8,525	1.18	8,525	1.18	8,525	1.18	6,925	.96
Diapause/O-W	---	---	27,108	3.74	20,330	2.81	13,554	1.87	---	---
Total	5,514	.76	35,633	4.92	28,855	3.99	22,079	3.05	6,925	.96

The sum of individual regions may not add to total because of rounding.

1/ Year 2 is the first year of full implementation, with phased-out incentive payments during years 3 and 4. Year 5 represents the continuing level of public costs for this program.

Table 6--Optimum Pest Management with No Incentives (OPM-NI) Program Annual Costs, by Regions and States 1/

State and Region	Year 1		Year 2	
	Total Cost	Cost Per Acre	Total Cost	Cost Per Acre
	1,000 dollars	Dollars	1,000 dollars	Dollars
North Carolina (Total)	66	1.10	81	1.37
North (2)	25	1.10	31	1.37
South (3)	35	1.10	44	1.37
Piedmont (4)	5	1.10	7	1.37
South Carolina (Total)	222	1.26	343	1.95
Coastal Plains (5)	197	1.26	305	1.95
Piedmont (6)	24	1.26	38	1.95
Georgia (Total)	222	.97	321	1.40
Piedmont (7)	24	.97	35	1.40
East (8)	90	.97	130	1.40
Southwest (9)	107	.97	156	1.40
Alabama (Total)	305	.68	443	.99
Limestone Valley (10)	180	.68	261	.99
South (11)	125	.68	181	.99
Tennessee (Total)	156	.46	235	.68
North Br. Loam (12)	121	.46	182	.68
South Br. Loam (13)	35	.46	53	.68
Missouri (14)	85	.30	117	.42
Mississippi (Total)	1,034	.74	1,556	1.11
Northeast (15)	188	1.98	229	2.42
North Central (16)	241	1.19	343	1.70
Delta (17)	346	.39	577	.64
South (18)	260	1.25	408	1.96
Arkansas (Total)	479	.51	844	.91
Northeast (19)	260	.57	464	1.01
Southeast (20)	218	.46	380	.80
Louisiana (Total)	384	.75	616	1.20
Northeast (21)	326	.75	523	1.20
Red River Valley (22)	58	.75	93	1.20
Texas (Total)	1,600	.67	2,119	.89
Lower Rio Grande (23)	192	.69	262	.94
Lower Bend (24)	160	1.35	202	1.70
Upper Bend (25)	112	1.25	149	1.66
Winter Garden (26)	83	4.06	87	4.24
Central River Bottom (27)	49	1.02	54	1.14
Blacklands (28)	400	.83	523	1.08
Rolling Plans (29)	444	.37	677	.56
Upper Concho (31)	160	1.21	165	1.25
Oklahoma (Total)	134	.28	195	.40
North (34)	68	.28	98	.40
South (35)	66	.28	96	.40
11 States Total	4,686	.65	6,869	.95

The sum of individual regions may not add to total because of rounding.

1/ Based on the assumption that it will take up to 2 years to hire additional personnel and fully implement the OPM-NI option, the second year in this table reflects the full implementation level of costs. The first year estimates assumes commitment of 50 percent of the additional resources needed.

Table 7--Optimum Pest Management with No Incentives and Boll Weevil Eradication (OPM-NI-BWE) Program Annual Costs: State and Beltwide Summary 1/

State and Item	Year													
	CIC 2/ Baseline	1	2	3	4	5	6	7	8	9	10	11	12	13
		Thousand Dollars												
N. Carolina:														
OPM	(50)	81	81	81	81	81	81	81	81	81	81	81	81	81
BWE	-	-	1,649	1,151	-	-	-	-	-	-	-	-	-	-
Monitoring	-	14	14	14	31	15	10	10	10	10	10	10	10	10
Total	(50)	95	1,744	1,246	111	96	91	91	91	91	91	91	91	91
S. Carolina:														
OPM	(101)	426	343	343	343	343	343	343	343	343	343	343	343	343
BWE	-	-	7,929	5,458	-	-	-	-	-	-	-	-	-	-
Monitoring	-	-	-	-	78	38	21	21	21	21	21	21	21	21
Total	(101)	426	8,272	5,801	422	381	364	364	364	364	364	364	364	364
Georgia:														
OPM	(123)	222	321	316	316	316	316	316	316	316	316	316	316	316
BWE	-	-	-	10,791	6,920	-	-	-	-	-	-	-	-	-
Monitoring	-	-	-	-	-	99	39	20	2-	20	20	20	20	20
Total	(123)	222	321	11,107	7,236	415	355	336	336	336	336	336	336	336
Alabama:														
OPM	(167)	305	443	443	443	443	443	443	443	443	443	443	443	443
BWE	-	-	-	19,282	13,241	-	-	-	-	-	-	-	-	-
Monitoring	-	-	-	-	-	189	75	38	38	38	38	38	38	38
Total	(167)	305	443	19,725	13,684	632	518	481	481	481	481	481	481	481
Tennessee:														
OPM	(78)	156	235	235	235	235	235	235	235	235	235	235	235	235
BWE	-	-	-	-	9,232	6,336	-	-	-	-	-	-	-	-
Monitoring	-	-	-	-	-	-	94	89	22	22	22	22	22	22
Total	(78)	156	235	235	9,467	6,571	329	324	257	257	257	257	257	257
Missouri:														
OPM	(54)	86	117	117	117	117	117	117	117	117	117	117	117	117
BWE	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Monitoring	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total	(54)	86	117	117	117	117	117	117	117	117	117	117	117	117
Mississippi:														
OPM	(512)	1,064	1,617	1,617	1,617	1,617	1,556	1,556	1,556	1,556	1,556	1,556	1,556	1,556
BWE	-	-	-	-	23,728	44,587	24,567	-	-	-	-	-	-	-
Monitoring	-	-	-	-	-	-	210	463	187	116	116	116	116	116
Total	(512)	1,064	1,617	1,617	25,345	46,204	26,333	2,019	1,743	1,672	1,672	1,672	1,672	1,672

Continued----------

Table 7--Optimum Pest Management with No Incentives and Boll Weevil Eradication (OPM-NI-BWE) Program Annual Costs: State and Beltwide Summary 1/ (Continued)

State and Item	Year													
	CIC 2/ Baseline	1	2	3	4	5	6	7	8	9	10	11	12	13
	Thousand Dollars													
Arkansas:														
OPM	(114)	479	844	844	844	844	844	844	844	844	844	844	844	844
BWE	-	-	-	-	16,812	33,549	13,718	-	-	-	-	-	-	-
Monitoring	-	-	-	-	-	-	191	275	116	79	79	79	79	79
Total	(114)	479	844	844	17,656	34,393	14,753	1,119	960	923	923	923	923	923
Louisiana:														
OPM	(152)	384	616	616	616	616	616	616	616	616	616	616	616	616
BWE	-	-	-	-	-	-	25,640	15,540	-	-	-	-	-	-
Monitoring	-	-	-	-	-	-	-	-	232	98	52	52	52	52
Total	(152)	384	616	616	616	616	26,256	16,156	848	714	668	668	668	668
Texas:														
OPM	(1,081)	2,866	4,651	4,651	4,651	4,651	4,651	4,651	4,651	3,956	2,857	2,119	2,119	2,119
BWE	-	-	-	-	-	-	-	25,155	58,236	51,607	12,504	-	-	-
Monitoring	-	-	-	-	-	-	-	-	-	270	581	452	230	216
Total	(1,081)	2,866	4,651	4,651	4,651	4,651	4,651	29,806	62,887	55,833	15,942	2,571	2,349	2,335
Oklahoma:														
OPM	(73)	134	195	195	195	195	195	195	195	195	195	195	195	195
BWE	-	-	-	-	-	-	-	-	5,819	4,467	-	-	-	-
Monitoring	-	-	-	-	-	-	-	-	-	-	69	29	14	14
Total	(73)	134	195	195	195	195	195	195	6,014	4,662	264	224	209	209
11-State Totals														
OPM	(2,504)	6,203	9,463	9,458	9,458	9,458	9,397	9,397	9,397	8,702	7,603	6,865	6,865	6,865
BWE	-	-	9,578	36,682	69,933	84,472	63,925	40,695	64,055	56,074	12,504	-	-	-
Monitoring	-	14	14	14	109	341	640	916	645	674	1,008	839	602	588
Total	(2,504)	6,217	19,055	46,154	79,500	94,271	73,962	51,008	74,097	65,450	21,115	7,704	7,467	7,453

1/ Eradication (BWE) costs include both producer and public shares of program implementation costs. Regional details are in Table 8. An OPM-NI program would be initiated in all States in year 1. Modified OPM would follow eradication.

2/ Items within parentheses indicate level of CIC funding in years prior to implementation.

Table 8--Optimum Pest Management with No Incentives and Boll Weevil Eradication (OPM-NI-BWE) Program Annual Costs, by Region and State 1/

State and Region	Year 1		Year 2		Year 3		Year 4		Year 5		Year 6 +	
	Total Cost	Cost Per Acre	Total Cost	Cost Per Acre	Total Cost	Cost Per Acre	Total Cost	Cost Per Acre	Total Cost	Cost Per Acre	Total Cost	Cost Per Acre
	$1,000	dol.	$1,000	dol.	$1,000	dol.	$1,000	dol.	$1,000	dol.	$1,000	dol.
North Carolina:												
North (2)												
OPM	31	1.34	31	1.34	31	1.34	31	1.34	31	1.34	31	1.34
BWE	---	---	---	---	---	---	---	---	---	---	---	---
Monitoring (1&2)	14	.62	14	.62	14	.62	7	.30	4	.17	4	.17
Total	45	1.96	45	1.96	45	1.96	38	1.64	35	1.51	35	1.51
South (3)												
OPM	43	1.34	43	1.34	43	1.34	43	1.34	43	1.34	43	1.34
BWE	---	---	1,444	45.11	995	31.08	---	---	---	---	---	---
Monitoring	---	---	---	---	---	---	19	.61	9	.29	5	.16
Total	43	1.34	1,487	46.45	1,038	32.42	62	1.95	52	1.63	48	1.50
Piedmont (4)												
OPM	7	1.34	7	1.34	7	1.34	7	1.34	7	1.34	7	1.34
BWE	---	---	205	41.02	156	31.13	---	---	---	---	---	---
Monitoring	---	---	---	---	---	---	5	.92	2	.44	1	.24
Total	7	1.34	212	42.36	163	32.47	11	2.26	9	1.78	8	1.58
South Carolina:												
Coastal Plains (5)												
OPM	379	2.42	305	1.95	305	1.95	305	1.95	305	1.95	305	1.95
BWE	---	---	7,051	45.06	4,852	31.01	---	---	---	---	---	---
Monitoring	---	---	---	---	---	---	70	.45	34	.22	19	.12
Total	379	2.42	7,356	47.01	5,157	32.96	375	2.40	339	2.17	324	2.07
Piedmont (6)												
OPM	47	2.42	38	1.95	38	1.95	38	1.95	38	1.95	38	1.95
BWE	---	---	878	45.49	606	31.39	---	---	---	---	---	---
Monitoring	---	---	---	---	---	---	9	.45	4	.21	2	.12
Total	47	2.42	916	47.44	644	33.34	46	2.40	42	2.16	40	2.07

Continued----------

Table 8--Optimum Pest Management with No Incentives and Boll Weevil Eradication (OPM-NI-BWE) Program Annual Costs, by Region and State 1/(Con'td.)

State and Region	Year 2 2/		Year 3		Year 4		Year 5		Year 6		Year 7 +	
	Total Cost	Cost Per Acre	Total Cost	Cost Per Acre	Total Cost	Cost Per Acre	Total Cost	Cost Per Acre	Total Cost	Cost Per Acre	Total Cost	Cost Per Acre
	$1,000	dol.	$1,000	dol.	$1,000	dol.	$1,000	dol.	$1,000	dol.	$1,000	dol.
Georgia:												
Piedmont (7)												
OPM	35	1.40	35	1.38	35	1.38	35	1.38	35	1.38	35	1.38
BWE	---	---	1,101	43.53	768	30.38	---	---	---	---	---	---
Monitoring	---	---	---	---	---	---	11	.42	4	.17	2	.09
Total	35	1.40	1,136	44.91	803	31.76	46	1.80	39	1.55	37	1.47
East (8)												
OPM	130	1.40	128	1.38	128	1.38	128	1.38	128	1.38	128	1.38
BWE	---	---	4,259	45.99	2,804	30.28	---	---	---	---	---	---
Monitoring	---	---	---	---	---	---	40	.43	16	.17	8	.09
Total	130	1.40	4,387	47.37	2,932	31.66	168	1.81	144	1.55	136	1.47
Southwest (9)												
OPM	156	1.40	153	1.38	153	1.38	153	1.38	153	1.38	153	1.38
BWE	---	---	5,431	48.88	3,348	30.13	---	---	---	---	---	---
Monitoring	---	---	---	---	---	---	48	.43	19	.17	10	.09
Total	156	1.40	5,584	50.26	3,501	31.51	201	1.81	172	1.55	163	1.47
Alabama:												
Limestone Valley (10)												
OPM	261	.99	261	.99	261	.99	261	.99	261	.99	261	.99
BWE	---	---	10,090	38.16	7,668	29.00	---	---	---	---	---	---
Monitoring	---	---	---	---	---	---	114	.43	45	.17	23	.09
Total	261	.99	10,351	39.15	7,929	29.99	375	1.42	306	1.16	284	1.08
South (11)												
OPM	181	.99	181	.99	181	.99	181	.99	181	.99	181	.99
BWE	---	---	9,192	50.12	5,573	30.39	---	---	---	---	---	---
Monitoring	---	---	---	---	---	---	75	.41	30	.16	15	.08
Total	181	.99	9,373	51.11	5,754	31.38	256	1.40	211	1.15	196	1.07

Continued----------

Table 8--Optimum Pest Management with No Incentives and Boll Weevil Eradication (OPM-NI-BWE) Program Annual Costs, by Region and State 1/(Con'td.)

State and Region	Year 3 2/		Year 4		Year 5		Year 6		Year 7		Year 8 +	
	Total Cost	Cost Per Acre	Total Cost	Cost Per Acre	Total Cost	Cost Per Acre	Total Cost	Cost Per Acre	Total Cost	Cost Per Acre	Total Cost	Cost Per Acre
	$1,000	dol.	$1,000	dol.	$1,000	dol.	$1,000	dol.	$1,000	dol.	$1,000	dol.
Tennessee:												
N. Brown Loam (12)												
OPM	182	.68	182	.68	182	.68	182	.68	182	.68	182	.68
BWE	---	---	5,686	21.41	3,989	15.02	---	---	---	---	---	---
Monitoring	---	---	---	---	---	---	57	.22	22	.08	13	.05
Total	182	.68	5,868	22.09	4,171	15.70	239	.90	204	.77	195	.73
S. Brown Loam (13)												
OPM	53	.68	53	.68	53	.68	53	.68	53	.68	53	.68
BWE	---	---	3,546	45.79	2,347	30.30	---	---	---	---	---	---
Monitoring	---	---	---	---	---	---	37	.48	14	.18	9	.12
Total	53	.68	3,599	46.47	2,400	30.98	90	1.16	67	.86	62	.80
Missouri: (14)												
OPM	117	.42	117	.42	117	.42	117	.42	117	.42	117	.42
BWE	---	---	---	---	---	---	---	---	---	---	---	---
Monitoring	---	---	---	---	---	---	---	---	---	---	---	---
Total	117	.42	117	.42	117	.42	117	.42	117	.42	117	.42
Mississippi:												
Northeast (15)												
OPM	250	2.64	250	2.64	250	2.64	229	2.42	229	2.42	229	2.42
BWE	---	---	4,410	46.57	2,858	30.18	---	---	---	---	---	---
Monitoring	---	---	---	---	---	---	39	.41	15	.16	9	.10
Total	250	2.64	4,660	49.21	3,108	32.82	268	2.83	244	2.57	238	2.51

Continued----------

Table 8--Optimum Pest Management with No Incentives and Boll Weevil Eradication (OPM-NI-BWE) Program Annual Costs, by Region and State 1/(Con'td.)

State and Region	Year 3 2/		Year 4		Year 5		Year 6		Year 6		Year 8 +	
	Total Cost	Cost Per Acre	Total Cost	Cost Per Acre	Total Cost	Cost Per Year	Total Cost	Cost Per Year	Total Cost	Cost Per Year	Total Cost	Cost Per Year
	$1,000	dol.	$1,000	dol.	$1,000	dol.	$1,000	dol.	$1,000	dol.	$1,000	dol.
Mississippi:												
North Central (16)												
OPM	354	1.76	354	1.76	354	1.76	343	1.70	343	1.70	343	1.70
BWE	---	---	9,356	46.44	6,054	30.05	---	---	---	---	---	---
Monitoring	---	---	---	---	---	---	84	.42	32	.16	20	.10
Total	354	1.76	9,710	48.20	6,408	31.81	427	2.12	348	1.86	363	1.80
Southern (18)												
OPM	436	2.09	436	2.09	436	2.09	408	1.96	408	1.96	408	1.96
BWE	---	---	9,962	47.76	6,252	29.97	---	---	---	---	---	---
Monitoring	---	---	---	---	---	---	87	.42	33	.16	20	.10
Total	436	2.09	10,398	49.85	6,688	32.06	495	2.37	441	2.11	428	2.05
Arkansas:												
Northeast (19)												
OPM	464	1.01	464	1.01	464	1.01	464	1.01	464	1.01	464	1.01
BWE	---	---	16,812	36.68	12,889	28.12	---	---	---	---	---	---
Monitoring	---	---	---	---	---	---	191	.42	73	.16	44	.10
Total	464	1.01	17,276	37.69	13,353	29.13	654	1.43	536	1.17	508	1.11

Continued----------

Table 8--Optimum Pest Management with No Incentives and Boll Weevil Eradication (OPM-NI-BWE) Program Annual Costs, by Region and State 1/(Con'td.)

State and Region	Year 4 2/		Year 5		Year 6		Year 7		Year 8		Year 9 +	
	Total Cost	Cost Per Acre	Total Cost	Cost Per Acre	Total Cost	Cost Per Acre	Total Cost	Cost Per Acre	Total Cost	Cost Per Acre	Total Cost	Cost Per Acre
	$1,000	dol.	$1,000	dol.	$1,000	dol.	$1,000	dol.	$1,000	dol.	$1,000	dol.
Mississippi												
Delta (17)												
OPM	577	.64	577	.64	577	.64	577	.64	577	.64	577	.64
BWE	---	---	29,423	32.84	24,567	27.42	---	---	---	---	---	---
Monitoring	---	---	---	---	---	---	383	.43	137	.15	67	.07
Total	577	.64	30,000	33.48	25,144	28.06	960	1.07	714	.80	644	.72
Arkansas:												
Southeast (20)												
OPM	380	.80	380	.80	380	.80	380	.80	380	.80	380	.80
BWE	---	---	20,660	43.75	13,718	29.05	---	---	---	---	---	---
Monitoring	---	---	---	---	---	---	202	.43	72	.15	35	.07
Total	380	.80	21,040	44.55	14,098	29.85	582	1.23	452	.96	414	.88

Continued----------

Table 8--Optimum Pest Management with No Incentives and Boll Weevil Eradication (OPM-NI-BWE) Program Annual Costs, by Region and State 1/(Con'td.)

State and Region	Year 5 2/		Year 6		Year 7		Year 8		Year 9		Year 10 +	
	Total Cost	Cost Per Acre	Total Cost	Cost Per Acre	Total Cost	Cost Per Acre	Total Cost	Cost Per Acre	Total Cost	Cost Per Acre	Total Cost	Cost Per Acre
	$1,000	dol.	$1,000	dol.	$1,000	dol.	$1,000	dol.	$1,000	dol.	$1,000	dol.
Louisiana:												
Northeast (21)												
OPM	523	1.20	523	1.20	523	1.20	523	1.20	523	1.20	523	1.20
BWE	---	---	21,730	49.99	13,158	30.27	---	---	---	---	---	---
Monitoring	---	---	---	---	---	---	197	.45	83	.19	44	.10
Total	523	1.20	22,253	51.14	13,687	31.47	720	1.66	606	1.39	567	1.30
Red River Valley (22)												
OPM	93	1.20	93	1.20	93	1.20	93	1.20	93	1.20	93	1.20
BWE	---	---	3,910	50.41	2,382	30.71	---	---	---	---	---	---
Monitoring	---	---	---	---	---	---	35	.45	15	.19	8	.10
Total	93	1.20	4,003	51.61	2,475	31.91	128	1.65	108	1.40	101	1.30

Continued----------

Table 8--Optimum Pest Management with No Incentives and Boll Weevil Eradication (OPM-NI-BWE) Program Annual Costs, by Region and State 1/(Con'td.)

State and Region	Year 6 2/		Year 7		Year 8		Year 9		Year 10		Year 11 +	
	Total Cost	Cost Per Acre	Total Cost	Cost Per Acre	Total Cost	Cost Per Acre	Total Cost	Cost Per Acre	Total Cost	Cost Per Acre	Total Cost	Cost Per Acre
	$1,000	dol.	$1,000	dol.	$1,000	dol.	$1,000	dol.	$1,000	dol.	$1,000	dol.
Texas:												
Upper Bend (25)												
OPM	309	3.45	309	3.45	309	3.45	149	1.66	149	1.66	149	1.66
BWE	---	---	3,791	42.29	2,619	29.22	---	---	---	---	---	---
Monitoring	---	---	---	---	---	---	39	.44	16	.18	8	.09
Total	309	3.45	4,100	45.74	2,925	32.67	188	2.10	165	1.84	157	1.75
C. River Bottoms (27)												
OPM	137	2.87	137	2.87	137	2.87	55	1.14	54	1.14	54	1.14
BWE	---	---	2,596	54.31	1,389	29.06	---	---	---	---	---	---
Monitoring	---	---	---	---	---	---	21	.44	9	.19	4	.08
Total	137	2.87	2,733	57.18	1,526	31.93	75	1.58	63	1.33	58	1.22
Blacklands (28)												
OPM	976	2.01	976	2.01	976	2.01	523	1.08	523	1.08	523	1.08
BWE	---	---	18,768	38.74	14,011	28.92	---	---	---	---	---	---
Monitoring	---	---	---	---	---	---	210	.42	87	.18	45	.09
Total	976	2.01	19,744	40.75	14,987	30.93	733	1.51	610	1.26	568	1.17

Continued----------

Table 8--Optimum Pest Management with No Incentives and Boll Weevil Eradication (OPM-NI-BWE) Program Annual Costs, by Region and State 1/(Con'td.)

State and Region	Year 7 2/		Year 8		Year 9		Year 10		Year 11		Year 12 +	
	Total Cost	Cost Per Acre	Total Cost	Cost Per Acre	Total Cost	Cost Per Acre	Total Cost	Cost Per Acre	Total Cost	Cost Per Acre	Total Cost	Cost Per Acre
	$1,000	dol.	$1,000	dol.	$1,000	dol.	$1,000	dol.	$1,000	dol.	$1,000	dol.
Texas:												
Rolling Plains (29)												
OPM	1,775	1.47	1,775	1.47	1,775	1.47	677	.56	677	.56	677	.56
BWE	---	---	34,172	28.28	26,169	21.66	---	---	---	---	---	---
Monitoring	---	---	---	---	---	---	412	.34	171	.14	86	.07
Total	1,775	1.47	35,947	29.75	27,944	23.13	1,089	.90	848	.70	763	.63
Upper Concho (31)												
OPM	165	1.25	165	1.25	165	1.25	165	1.25	165	1.25	165	1.25
BWE	---	---	6,045	45.74	3,873	29.30	---	---	---	---	---	---
Monitoring	---	---	---	---	---	---	57	.43	24	.18	12	.09
Total	165	1.25	6,210	46.99	4,038	30.55	222	1.68	189	1.43	177	1.34
Oklahoma:												
N. Rolling Plains (34)												
OPM	98	.40	98	0.40	98	.40	98	0.40	98	.40	98	.40
BWE	---	---	---	---	---	---	---	---	---	---	---	---
Monitoring	---	---	---	---	---	---	---	---	---	---	---	---
Total	98	.40	98	.40	98	.40	98	0.40	98	.40	98	.40
S. Rolling Plains (35)												
OPM	96	.40	96	.40	96	.40	96	0.40	96	.40	96	.40
BWE	---	---	5,819	27.34	4,467	20.99	---	---	---	---	---	---
Monitoring	---	---	---	---	---	---	69	.29	29	.12	14	.06
Total	96	.40	5,915	27.74	4,563	21.39	165	.69	125	.52	110	.46

Continued----------

Table 8--Optimum Pest Management with No Incentives and Boll Weevil Eradication (OPM-NI-BWE) Program Annual Costs, by Region and State 1/(Con'td.)

State and Region	Year 8 2/		Year 9		Year 10		Year 11		Year 12		Year 13 +	
	Total Cost	Cost Per Acre	Total Cost	Cost Per Acre	Total Cost	Cost Per Acre	Total Cost	Cost Per Acre	Total Cost	Cost Per Acre	Total Cost	Cost Per Acre
	$1,000	dol.	$1,000	dol.	$1,000	dol.	$1,000	dol.	$1,000	dol.	$1,000	dol.
Texas:												
Lower Rio Grande (23)												
OPM	763	2.74	763	2.74	763	2.74	262	.94	262	.94	262	.94
BWE	---	---	15,408	55.26	8,404	30.14	---	---	---	---	---	---
Monitoring	---	---	---	---	---	---	133	.48	50	.18	41	.15
Total	763	2.74	16,171	58.00	9,167	32.88	395	1.42	312	1.12	303	1.09
Lower Bend (24)												
OPM	359	3.02	359	3.02	359	3.02	202	1.70	202	1.70	202	1.70
BWE	---	---	5,026	42.29	3,480	29.28	---	---	---	---	---	---
Monitoring	---	---	---	---	---	---	57	.48	21	.18	17	.14
Total	359	3.02	5,385	45.31	3,839	32.30	259	2.18	223	1.88	219	1.84
Winter Garden (26)												
OPM	167	8.18	167	8.18	167	8.18	87	4.24	87	4.24	87	4.24
BWE	---	---	1,131	55.40	620	30.37	---	---	---	---	---	---
Monitoring	---	---	---	---	---	---	10	.49	4	.20	3	.15
Total	167	8.18	1,298	63.58	787	38.55	97	4.73	91	4.44	90	4.39

1/ An OPM-NI option will be implemented in all regions in year 1, in the year immediately preceding eradication in North Carolina. Eradication (BWE) will be phased across cotton belt followed by continuous monitoring for incipient infestations. All eradication costs (BWE) shown in this table represent both public (APHIS) and producer shares of eradication operational costs. Alternative producer shares were evaluated by the Economic Evaluation Team. Monitoring costs and OPM costs are public costs. Capital outlays totaling about $20 million are excluded.

2/ Costs in this column represent CES full funding of an OPM-NI option prior to eradication, starting in year 1 at 50% of full funding and thereafter at 100%. In North Carolina and South Carolina, full funding is assumed in year 1, which is the year immediately proceeding eradication.

Table 9--Current Insect Control With Boll Weevil Eradication (CIC-BWE) Program Annual Costs: State and Beltwide Summary 1/

State and Item	Year												
	1	2	3	4	5	6	7	8	9	10	11	12	13
	Thousand Dollars												
North Carolina:													
CIC	50	50	50	50	50	50	50	50	50	50	50	50	50
BWE	-	1,649	1,151	-	-	-	-	-	-	-	-	-	-
Monitoring	14	14	14	31	15	10	10	10	10	10	10	10	10
Total	64	1,713	1,215	81	65	60	60	60	60	60	60	60	60
South Carolina:													
CIC	101	101	101	101	101	101	101	101	101	101	101	101	101
BWE	-	7,929	5,458	-	-	-	-	-	-	-	-	-	-
Monitoring	-	-	-	78	38	21	21	21	21	21	21	21	21
Total	101	8,030	5,559	179	139	122	122	122	122	122	122	122	122
Georgia:													
CIC	123	123	123	123	123	123	123	123	123	123	123	123	123
BWE	-	-	10,791	6,920	-	-	-	-	-	-	-	-	-
Monitoring	-	-	-	-	99	39	20	20	20	20	20	20	20
Total	123	123	10,914	7,043	222	162	143	143	143	143	143	143	143
Alabama:													
CIC	167	167	167	167	167	167	167	167	167	167	167	167	167
BWE	-	-	19,282	13,241	-	-	-	-	-	-	-	-	-
Monitoring	-	-	-	-	189	75	38	38	38	38	38	38	38
Total	167	167	19,449	13,408	346	242	205	205	205	205	205	205	205
Tennessee:													
CIC	78	78	78	78	78	78	78	78	78	78	78	78	78
BWE	-	-	-	9,232	6,336	-	-	-	-	-	-	-	-
Monitoring	-	-	-	-	-	94	89	22	22	22	22	22	22
Total	78	78	78	9,310	6,414	172	167	100	100	100	100	100	100
Missouri:													
CIC	54	54	54	54	54	54	54	54	54	54	54	54	54
BWE	None												
Monitoring	None												
Total	54	54	54	54	54	54	54	54	54	54	54	54	54
Mississippi:													
CIC	512	512	512	512	512	512	512	512	512	512	512	512	512
BWE	-	-	-	23,728	44,587	24,567	-	-	-	-	-	-	-
Monitoring	-	-	-	-	-	210	463	186	116	116	116	116	116
Total	512	512	512	24,240	45,099	25,289	975	698	628	626	628	628	628

Continued----------

Table 9--Current Insect Control With Boll Weevil Eradication (CIC-BWE) Program Annual Costs: State and Beltwide Summary 1/
(Continued)

State and Item	Year												
	1	2	3	4	5	6	7	8	9	10	11	12	13
	Thousand Dollars												
Arkansas:													
CIC	114	114	114	114	114	114	114	114	114	114	114	114	114
BWE	-	-	-	16,812	33,549	13,718	-	-	-	-	-	-	-
Monitoring	-	-	-	-	-	191	275	116	79	79	79	79	79
Total	114	114	114	16,926	33,663	14,023	389	230	193	193	193	193	193
Louisiana:													
CIC	152	152	152	152	152	152	152	152	152	152	152	152	152
BWE	-	-	-	-	-	25,640	15,540	-	-	-	-	-	-
Monitoring	-	-	-	-	-	-	-	232	98	52	52	52	52
Total	152	152	152	152	152	25,792	15,692	384	250	204	204	204	204
Texas:													
CIC	1,081	1,081	1,081	1,081	1,081	1,081	1,081	1,081	1,081	1,081	1,081	1,081	1,081
BWE	-	-	-	-	-	-	25,155	58,236	51,607	12,504	-	-	-
Monitoring	-	-	-	-	-	-	-	-	270	581	452	230	216
Total	1,081	1,081	1,081	1,081	1,081	1,081	26,236	59,317	52,958	14,166	1,533	1,311	1,297
Oklahoma:													
CIC	73	73	73	73	73	73	73	73	73	73	73	73	73
BWE	-	-	-	-	-	-	-	5,819	4,467	-	-	-	-
Monitoring	-	-	-	-	-	-	-	-	-	69	29	14	14
Total	73	73	73	73	73	73	73	5,892	4,540	142	102	87	87
11-State Totals													
CIC	2,504	2,504	2,504	2,504	2,504	2,504	2,504	2,504	2,504	2,504	2,504	2,504	2,504
BWE	-	9,578	36,682	69,931	84,472	63,925	40,695	64,055	56,074	12,504	-	-	-
Monitoring	14	14	14	109	341	640	916	645	674	1,008	839	602	588
Total	2,518	12,096	39,200	72,544	87,317	67,069	44,115	67,204	59,252	16,016	3,343	3,106	3,092

1/ Regional details are shown in Table 10. BWE is time-sequenced as indicated in the beltwide operational plan. No additional funding of CES activities is provided.

Table 10--Current Insect Control with Boll Weevil Eradication (CIC-BWE) Program Annual Costs, by Region and State 1/

State and Region	Year 1		Year 2		Year 3		Year 4		Year 5		Year 6 +	
	Total Cost	Cost Per Acre	Total Cost	Cost Per Acre	Total Cost	Cost Per Acre	Total Cost	Cost Per Acre	Total Cost	Cost Per Acre	Total Cost	Cost Per Acre
	$1,000	Dol.	$1,000	Dol.	$1,000	Dol.	$1,000	Dol.	$1,000	Dol.	$1,000	Dol.
North Carolina:												
North (2)												
CIC	19	.83	19	.83	19	.83	19	.83	19	.83	19	.83
BWE	---	---	---	---	---	---	---	---	---	---	---	---
Monitoring	14	.62	14	.62	14	.62	7	.30	4	.17	4	.17
Total	33	1.45	33	1.45	33	1.45	25	1.13	23	1.00	23	1.00
South (3)												
CIC	27	.83	27	.83	27	.83	27	.83	27	.83	27	.83
BWE	---	---	1,444	45.11	995	31.08	---	---	---	---	---	---
Monitoring	---	---	---	---	---	---	19	.61	9	.29	5	.16
Total	27	.83	1,471	45.94	1,022	31.91	46	1.44	36	1.12	32	.99
Piedmont (4)												
CIC	4	.83	4	.83	4	.83	4	.83	4	.83	4	.83
BWE	---	---	205	41.02	156	31.13	---	---	---	---	---	---
Monitoring	---	---	---	---	---	---	5	.92	2	.44	1	.24
Total	4	.83	209	41.85	160	31.96	9	1.75	6	1.27	5	1.07
South Carolina:												
Coastal Plains (5)												
CIC	89	.57	89	.57	89	.57	89	.57	89	.57	89	.57
BWE	---	---	7,051	45.06	4,852	31.01	---	---	---	---	---	---
Monitoring	---	---	---	---	---	---	70	.45	34	.22	19	.12
Total	89	.57	7,140	45.63	4,941	31.58	159	1.02	123	.79	108	.69
Piedmont (6)												
CIC	11	.57	11	.57	11	.57	11	.57	11	.57	11	.57
BWE	---	---	878	45.49	606	31.39	---	---	---	---	---	---
Monitoring	---	---	---	---	---	---	9	.45	4	.21	2	.12
Total	11	.57	889	46.06	617	31.96	20	1.02	15	.78	13	.69

Continued----------

Table 10--Current Insect Control with Boll Weevil Eradication (CIC-BWE) Program Annual Costs, by Region and State 1/(Con'td.)

State and Region	Year 2		Year 3		Year 4		Year 5		Year 6		Year 7 +	
	Total Cost	Cost Per Acre	Total Cost	Cost Per Acre	Total Cost	Cost Per Acre	Total Cost	Cost Per Acre	Total Cost	Cost Per Acre	Total Cost	Cost Per Acre
	$1,000	Dol.	$1,000	Dol.	$1,000	Dol.	$1,000	Dol.	Dol.	$1,000	Dol.	$1,000
Georgia:												
Piedmont (7)												
CIC	14	.54	14	.54	14	.54	14	.54	14	.54	14	.54
BWE	---	---	1,101	43.53	768	30.38	---	---	---	---	---	---
Monitoring	---	---	---	---	---	---	11	.42	4	.17	2	.09
Total	14	.54	1,115	44.07	782	30.92	24	.96	18	.71	16	.63
East (8)												
CIC	50	.54	50	.54	50	.54	50	.54	50	.54	50	.54
BWE	---	---	4,259	45.99	2,804	30.28	---	---	---	---	---	---
Monitoring	---	---	---	---	---	---	40	.43	16	.17	8	.09
Total	50	.54	4,309	46.53	2,854	30.82	90	.97	66	.71	58	.63
Southwest (9)												
CIC	60	.54	60	.54	60	.54	60	.54	60	.54	60	.54
BWE	---	---	5,431	48.88	3,348	30.13	---	---	---	---	---	---
Monitoring	---	---	---	---	---	---	48	.43	19	.17	10	.09
Total	60	.54	5,491	49.42	3,408	30.67	108	.97	79	.71	70	.63
Alabama:												
Limestone Valley (10)												
CIC	99	.37	99	.37	99	.37	99	.37	99	.37	99	.37
BWE	---	---	10,090	38.16	7,668	29.00	---	---	---	---	---	---
Monitoring	---	---	---	---	---	---	114	.43	45	.17	23	.09
Total	99	.37	10,189	38.53	7,767	29.37	213	.80	144	.54	122	.46
South (11)												
CIC	68	.37	68	.37	68	.37	68	.37	68	.37	68	.37
BWE	---	---	9,192	50.12	5,573	30.39	---	---	---	---	---	---
Monitoring	---	---	---	---	---	---	75	.41	30	.16	15	.08
Total	68	.37	9,260	50.49	5,641	30.76	143	.78	98	.53	83	.45

Continued----------

Table 10--Current Insect Control with Boll Weevil Eradication (CIC-BWE) Program Annual Costs, by Region and State 1/(Con'td.)

State and Region	Year 3		Year 4		Year 5		Year 6		Year 7		Year 8 +	
	Total Cost	Cost Per Acre	Total Cost	Cost Per Acre	Total Cost	Cost Per Acre	Total Cost	Cost Per Acre	Total Cost	Cost Per Acre	Total Cost	Cost Per Acre
	$1,000	Dol.	$1,000	Dol.	$1,000	Dol.	$1,000	Dol.	$1,000	Dol.	$1,000	Dol.
Tennessee:												
N. Brown Loam (12)												
CIC	60	.23	60	.23	60	.23	60	.23	60	.23	60	.23
BWE	---	---	5,686	21.41	3,989	15.02	---	---	---	---	---	---
Monitoring	---	---	---	---	---	---	57	.22	22	.08	13	.05
Total	60	.23	5,746	21.64	4,049	15.25	117	.45	82	.31	73	.28
S. Brown Loam (13)												
CIC	18	.23	18	.23	18	.23	18	.23	18	.23	18	.23
BWE	---	---	3,546	45.79	2,347	30.30	---	---	---	---	---	---
Monitoring	---	---	---	---	---	---	37	.48	14	.18	9	.12
Total	18	.23	3,564	46.02	2,365	30.53	55	.71	32	.41	27	.35
Missouri: (14)												
CIC	54	.19	54	.19	54	.19	54	.19	54	.19	54	.19
BWE	---	---	---	---	---	---	---	---	---	---	---	---
Monitoring	---	---	---	---	---	---	---	---	---	---	---	---
Total	54	.19	54	.19	54	.19	54	.19	54	.19	54	.19
Mississippi:												
Northeast (15)												
CIC	146	1.55	146	1.55	146	1.55	146	1.55	146	1.55	146	1.55
BWE	---	---	4,410	46.57	2,858	30.18	---	---	---	---	---	---
Monitoring	---	---	---	---	---	---	39	.41	15	.16	9	.10
Total	146	1.55	4,556	48.12	3,004	31.73	185	1.96	161	1.71	155	1.65
North Central (16)												
CIC	139	.69	139	.69	139	.69	139	.69	139	.69	139	.69
BWE	---	---	9,356	46.44	6,054	30.05	---	---	---	---	---	---
Monitoring	---	---	---	---	---	---	84	.42	32	.16	20	.10
Total	139	.69	9,495	47.13	6,193	30.74	223	1.11	171	.85	159	.79

Continued----------

Table 10--Current Insect Control with Boll Weevil Eradication (CIC-BWE) Program Annual Costs, by Region and State 1/(Con'td.)

State and Region	Year 3		Year 4		Year 5		Year 6		Year 7		Year 8	
	Total Cost	Cost Per Acre	Total Cost	Cost Per Acre	Total Cost	Cost Per Acre	Total Cost	Cost Per Acre	Total Cost	Cost Per Acre	Total Cost	Cost Per Acre
	$1,000	Dol.	$1,000	Dol.	$1,000	Dol.	$1,000	Dol.	$1,000	Dol.	$1,000	Dol.
Mississippi:												
South (18)												
CIC	112	.54	112	.54	112	.54	112	.54	112	.54	112	.54
BWE	---	---	9,962	47.76	6,252	29.97	---	---	---	---	---	---
Monitoring	---	---	---	---	---	---	87	.42	33	.16	20	.10
Total	112	.54	10,074	48.30	6,364	30.51	199	.96	145	.70	132	.64
Arkansas:												
Northeast (19)												
CIC	57	.12	57	.12	57	.12	57	.12	57	.12	57	.12
BWE	---	---	16,812	36.68	12,889	28.12	---	---	---	---	---	---
Monitoring	---	---	---	---	---	---	191	.42	73	.16	44	.10
Total	57	.12	16,926	36.80	12,946	28.24	248	.54	130	.28	101	.22

Continued----------

Table 10--Current Insect Control with Boll Weevil Eradication (CIC-BWE) Program Annual Costs, by Region and State 1/(Con'td.)

State and Regon	Year 4		Year 5		Year 6		Year 7		Year 8		Year 9 +	
	Total Cost	Cost Per Acre	Total Cost	Cost Per Acre	Total Cost	Cost Per Acre	Total Cost	Cost Per Acre	Total Cost	Cost Per Acre	Total Cost	Cost Per Acre
	$1,000	Dol.	$1,000	Dol.	$1,000	Dol.	$1,000	Dol.	$1,000	Dol.	$1,000	Dol.
Mississippi												
Delta (17)												
CIC	114	.13	114	.13	114	.13	114	.13	114	.13	114	.13
BWE	---	---	29,423	32.84	24,567	27.42	---	---	---	---	---	---
Monitoring	---	---	---	---	---	---	383	.43	137	.15	67	.07
Total	114	.13	29,537	32.97	24,681	27.55	497	.56	251	.28	181	.20
Arkansas:												
Southeast (20)												
CIC	57	.12	57	.12	57	.12	57	.12	57	.12	57	.12
BWE	---	---	20,660	43.75	13,718	29.05	---	---	---	---	---	---
Monitoring	---	---	---	---	---	---	202	.43	72	.15	35	.07
Total	57	.12	20,717	43.87	13,775	29.17	259	.55	129	.27	92	.19

Continued----------

Table 10--Current Insect Control with Boll Weevil Eradication (CIC-BWE) Program Annual Costs, by Region and State 1/(Con'td.)

State and Region	Year 5		Year 6		Year 7		Year 8		Year 9		Year 10 +	
	Total Cost	Cost Per Acre	Total Cost	Cost Per Acre	Total Cost	Cost Per Acre	Total Cost	Cost Per Acre	Total Cost	Cost Per Acre	Total Cost	Cost Per Acre
	$1,000	Dol.	$1,000	Dol.	$1,000	Dol.	$1,000	Dol.	$1,000	Dol.	$1,000	Dol.
Louisiana:												
Northeast (21)												
CIC	129	.30	129	.30	129	.30	129	.30	129	.30	129	.30
BWE	---	---	21,730	49.99	13,158	30.27	---	---	---	---	---	---
Monitoring	---	---	---	---	---	---	197	.45	83	.19	44	.10
Total	129	.30	21,859	50.29	13,287	30.57	326	.75	212	.49	180	.40
Red River Valley (22)												
CIC	23	.30	23	.30	23	.30	23	.30	23	.30	23	.30
BWE	---	---	3,910	50.41	2,382	30.71	---	---	---	---	---	---
Monitoring	---	---	---	---	---	---	35	.45	15	.19	8	.10
Total	23	.30	3,933	50.71	2,405	31.01	58	.75	38	.49	31	.40

Continued----------

Table 10--Current Insect Control with Boll Weevil Eradication (CIC-BWE) Program Annual Costs, by Region and State 1/(Con'td.)

State and Region	Year 6		Year 7		Year 8		Year 9		Year 10		Year 11 +	
	Total Cost	Cost Per Acre	Total Cost	Cost Per Acre	Total Cost	Cost Per Acre	Total Cost	Cost Per Acre	Total Cost	Cost Per Acre	Total Cost	Cost Per Acre
	$1,000	Dol.	$1,000	Dol.	$1,000	Dol.	$1,000	Dol.	$1,000	Dol.	$1,000	Dol.
Texas:												
Upper Bend (25)												
CIC	76	.84	76	.84	76	.84	76	.84	76	.84	76	.84
BWE	---	---	3,791	42.29	2,619	29.22	---	---	---	---	---	---
Monitoring	---	---	---	---	---	---	39	.44	16	.18	8	.09
Total	76	.84	3,867	43.13	2,695	30..06	115	1.28	92	1.02	84	.93
C. River Bottom (27)												
CIC	43	.90	43	.90	43	.90	43	.90	43	.90	43	.90
BWE	---	---	2,596	54.31	1,389	29.06	---	---	---	---	---	---
Monitoring	---	---	---	---	---	---	21	.44	9	.19	4	.08
Total	43	.90	2,639	55.21	1,432	29.96	64	1.34	52	1.09	47	.98
Blacklands (28)												
CIC	278	.57	278	.57	278	.57	278	.57	278	.57	278	.57
BWE	---	---	18,768	38.74	14,011	28.92	---	---	---	---	---	---
Monitoring	---	---	---	---	---	---	210	.43	87	.18	45	.09
Total	278	.57	19,046	39.31	14,289	29.49	408	1.00	365	.75	323	.66

Continued----------

Table 10--Current Insect Control with Boll Weevil Eradication (CIC-BWE) Program Annual Costs, by Region and State 1/(Con'td.)

State and Region	Year 7		Year 8		Year 9		Year 10		Year 11		Year 12 +	
	Total Cost	Cost Per Acre	Total Cost	Cost Per Acre	Total Cost	Cost Per Acre	Total Cost	Cost Per Acre	Total Cost	Cost Per Acre	Total Cost	Cost Per Acre
	$1,000	Dol.	$1,000	Dol.	$1,000	Dol.	$1,000	Dol.	$1,000	Dol.	$1,000	Dol.
Texas:												
Rolling Plains (29)												
CIC	211	.17	211	.17	211	.17	211	.17	211	.17	211	.17
BWE	---	---	34,172	28.28	26,169	21.66	---	---	---	---	---	---
Monitoring	---	---	---	---	---	---	412	.34	171	.14	86	.07
Total	211	.17	34,383	28.45	26,380	21.83	623	.51	382	.31	297	.24
Upper Concho (31)												
CIC	155	1.18	155	1.18	155	1.18	155	1.18	155	1.18	155	1.18
BWE	---	---	6,045	45.74	3,873	29.30	---	---	---	---	---	---
Monitoring	---	---	---	---	---	---	57	.43	24	.18	12	.09
Total	155	1.18	6,200	46.92	4,028	30.48	212	1.61	179	1.36	167	1.27
Oklahoma:												
North Rolling Plains (34)												
CIC	37	.15	37	.15	37	.15	37	.15	37	.15	37	.15
BWE	---	---	---	---	---	---	---	---	---	---	---	---
Monitoring	---	---	---	---	---	---	---	---	---	---	---	---
Total	37	.15	37	.15	37	.15	37	.15	37	.15	37	.15
South Rolling Plains (35)												
CIC	36	.15	36	.15	36	.15	36	.15	36	.15	36	.15
BWE	---	---	5,819	27.34	4,467	20.99	---	---	---	---	---	---
Monitoring	---	---	---	---	---	---	69	.29	29	.12	14	.06
Total	36	.15	5,855	27.49	4,503	21.14	105	.44	65	.27	50	.21

Continued----------

Table 10--Current Insect Control with Boll Weevil Eradication (CIC-BWE) Program Annual Costs, by Region and State 1/(Con'td.

State and Region	Year 8		Year 9		Year 10		Year 11		Year 12		Year 13 +	
	Total Cost	Cost Per Acre	Total Cost	Cost Per Acre	Total Cost	Cost Per Acre	Total Cost	Cost Per Acre	Total Cost	Cost Per Acre	Total Cost	Cost Per Acre
	$1,000	Dol.	$1,000	Dol.	$1,000	Dol.	$1,000	Dol.	$1,000	Dol.	$1,000	Dol.
Texas:												
Lower Rio Grande (23)												
CIC	121	.43	121	.43	121	.43	121	.43	121	.43	121	.43
BWE	---	---	15,408	55.26	8,404	30.14	---	---	---	---	---	---
Monitoring	---	---	---	---	---	---	133	.48	50	.18	41	.15
Total	121	.43	15,529	55.69	8,525	30.57	254	.91	171	.61	162	.58
Lower Bend (24)												
CIC	118	.99	118	.99	118	.99	118	.99	118	.99	118	.99
BWE	---	---	5,026	42.29	3,480	29.28	---	---	---	---	---	---
Monitoring	---	---	---	---	---	---	57	.48	21	.18	17	.14
Total	118	.99	5,144	43.28	3,598	30.27	175	1.47	139	1.17	135	1.13
Winter Garden (26)												
CIC	79	3.89	79	3.89	79	3.89	79	3.89	79	3.89	79	3.89
BWE	---	---	1,131	55.40	620	30.37	---	---	---	---	---	---
Monitoring	---	---	---	---	---	---	10	.49	4	.20	3	.15
Total	79	3.89	1,210	59.29	699	34.26	89	4.38	83	4.09	82	4.04

1/ Eradication (BWE) and monitoring costs are the same as those in Table 9, whereas the CIC level of CES funding is assumed rather than OPM-NI. See Footnote 1 of Table 9 for other details.

OPTIMUM PEST MANAGEMENT

FOR

BOLL WEEVIL INFESTED AREAS

CONTENTS

OPTIMUM PEST MANAGEMENT
FOR
BOLL-WEEVIL INFESTED AREAS

INTRODUCTION

Optimum Pest Management (OPM) is a program for suppressing boll weevils and managing other cotton insect pests and beneficial insects in boll weevil-infested areas. It is based in large part on the OPM Trial conducted in Mississippi (Panola County) in 1978-80 and on ongoing research and extension experience in the 11 States involved.

OPM is a voluntary program that would be organized and managed by the Cooperative Extension Service of 11 boll weevil infested States from North Carolina through Texas. Thus, the "beltwide" OPM program is an amalgam of 11 State programs, each of which reflects the unique combination of biological, environmental and organizational factors affecting cotton insect control programs within each State.

The responsibility for developing plans for State OPM programs was assumed by the OPM Regional Extension Education Advisory Committee (OPMREEAC). Its membership consisted of one CES cotton entomologist from each of the boll weevil infested States involved, as follows:

North Carolina -- Jack Bacheler
South Carolina -- Donald R. Johnson
Georgia -- W. R. Lambert
Alabama -- Ron Smith
Tennessee -- Jimmy Pendergrass
Missouri -- Ed Kowalski
Mississippi -- Jim Hamer
Arkansas -- Gordon Barnes
Louisiana -- James Tynes
Texas -- Mike McWhorter
Oklahoma -- Eldon Cleveland

These entomologists developed the OPM program specifications and components, as well as associated public expenditures for their respective States. This activity was coordinated by David Young, Leader, Extension Entomology, Mississippi Cooperative Extension Service.

Review was provided by the Program Definition and Cost Facilitator Group, whose membership represented involved Federal and State agencies.

The overall objective of the beltwide OPM programs is to economically manage cotton insects with a minimum of environmental degradation. Corollary objectives are to assure minimum effective levels of beneficial insects, acceptable levels of pesticide usage, and to maintain or improve yields.

PROGRAM SPECIFICATIONS

OPM Programs for Beltwide Implementation

Four OPM programs were developed for boll weevil infested areas of the cotton belt. A common requirement of all OPM programs is that additional Extension personnel and support would be required to provide technical assistance and educational guidance in the management of the boll weevil and other cotton insects. The focus of the term Optimum Pest Management is on insect management.

A general description of beltwide OPM programs follows:

1. Optimum Pest Management with Continuing Incentive Payments for Boll Weevil Management (OPM-I): This beltwide program consists of two major insect management options, whichever is most applicable for a particular area. Additional Extension personnel and support would be required to implement both options. One option, Optimum Pest Management (OPM), would utilize the boll weevil/cotton insect management practices that were tested in the Mississippi Trial with emphasis on diapause and/or pinhead square treatment, as needed, and full reimbursement for the cost of these treatments. In all areas where the diapause strategy could not be implemented or where it is not needed, an alternate option, Modified Optimum Pest Management (MOPM), would be followed. It would utilize, if applicable, all of the practices tested in the Mississippi Trial except the organized area-wide diapause strategy.

   In areas having potential for moderate-to-heavy infestations of boll weevils, the OPM option would be implemented where effective. Diapause and/or pinhead square treatments would be specified as recommended technology. The criterion for an effective program is to maintain the mid-season population of boll weevils below treatment levels on 90% or more of the acreage prior to onset of Heliothis pressure. Growers would be reimbursed for boll weevil diapause and pinhead square treatments at a level that achieves sufficient acreage to result in an effective program.

   However, in areas, if any, where the required acreage for an effective program could not be reached with the OPM option or where boll weevil infestations are historically light and usually do not reach treatment levels, the Modified Optimum Pest Management (MOPM) option would be implemented. This option implies that the diapause and/or pinhead square technology either could not be adopted on a sufficient percentage of the cotton acreage for an an effective area-wide OPM option or it would not be needed because of the low population levels of boll weevil. The objective of MOPM is to reduce the number of unnecessary in-season treatments for boll weevil and other cotton insects through effective scouting and/or monitoring. Examples of areas where diapause and/or pinhead square treatments are not commonly needed may include north Alabama, north Oklahoma, and the Upper Concho Basin of Texas.

To implement both options under the OPM-I program, additional extension personnel and funds would be required to provide technical information and educational guidance in the management of boll weevils and other cotton insects. All available proven technology may be applied in implementing this program. Use of the technology recommended and participation in this program would be voluntary on the part of the grower. From 1 to 2 years may be required to fully implement this program, depending on cotton acreage and availability of staff. The acreage that one entomologist can handle will vary because of the location and intensity of cotton acreage as well as historic patterns of insect management problems.

2. Optimum Pest Management with Phased Incentive Payments for Boll Weevil Management (OPM-PI): All recommended program components including personnel and funds are the same as OPM-I except that incentive payments for diapause and/or pinhead square treatments are phased-out over time as follows:

1st year:	Same as OPM-I, 100% of needed treatment
2nd year:	75% of needed treatment
3rd year:	50% of needed treatment
4th year:	No incentive payment

The logic in evaluating this program is that in some areas an incentive may serve to demonstrate the technical and economic feasibility of conducting a program and that growers may follow up with effective control programs. If the required acreage for an effective diapause/pinhead square program could not be maintained after payments are phased out, the MOPM option would be implemented.

3. Optimum Pest Management with No Incentive Payments for Boll Weevil Management (OPM-NI): This beltwide program is the same as OPM-I with the exception that no reimbursements to producers are made for diapause or pinhead square treatments. If the required level of acreage could not be reached, the MOPM option would be established and the diapause/pinhead square technology would not be implemented on an area-wide basis.

4. Optimum Pest Management with No Incentive Payment and Boll Weevil Eradication (OPM-NI-BWE): Includes eradication of the boll weevil as a major component in implementing a cotton insect management program. To insure efficient implementation of this program, OPM-NI would be in place beltwide prior to eradication and MOPM would be in place during and following eradication. The beltwide eradication component would use the technology proven by the North Carolina trial and ongoing research. The details of the OPM-NI-BWE option are included in Table 8 and Attachment B of this report.

Guidelines for Beltwide OPM Programs

In implementing a beltwide OPM program, it is important to provide the required flexibility to reflect local conditions. Some components of the Mississipi OPM Trial are not needed elsewhere. State programs are flexible enough to be tailored to the producer's operations as required to make the program effective. However, the Mississippi trial technologies and practices were adapted to the extent applicable and necessary in the State plans. In brief, the Mississippi approach involved the following technologies and practices:

1. An organized effort was made to gain participation of growers and consultants in the OPM program.

2. In-field and peripheral pheromone traps were used for survey and field population estimates, with traps installed at about one trap per 20 acres in Panola County.

3. All acreage of participating growers was scouted at least once a week, with some acreage scouted twice by consultants, Extension Service personnel or producers.

4. Pinhead square insecticide applications for control of over-wintered boll weevil populations were scheduled if needed.

5. In-season insect control was in accordance with guidelines given in the Mississippi Cotton Insect Control Guide.

6. Diapause applications were initiated in Panola County in September and continued on a 10 to 15 day interval for three to four applications each year.

7. Stalk destruction was encouraged as harvest permitted.

An additional set of guidelines was provided to each State OPMREEAC member in order to promote comparability of approach and resulting estimates. These guidelines were as follows:

1. Current Insect Control (CIC) is the baseline comparison with other alternatives.

2. Program specifications and costs are limited to cotton insect control programs, with emphasis on control of boll weevils.

3. Program specifications and costs are to be developed for each cotton production region (Figure 1).

4. Baseline acreage for all programs will be the 1974/78 acreage reported by the Crop Reporting Service.

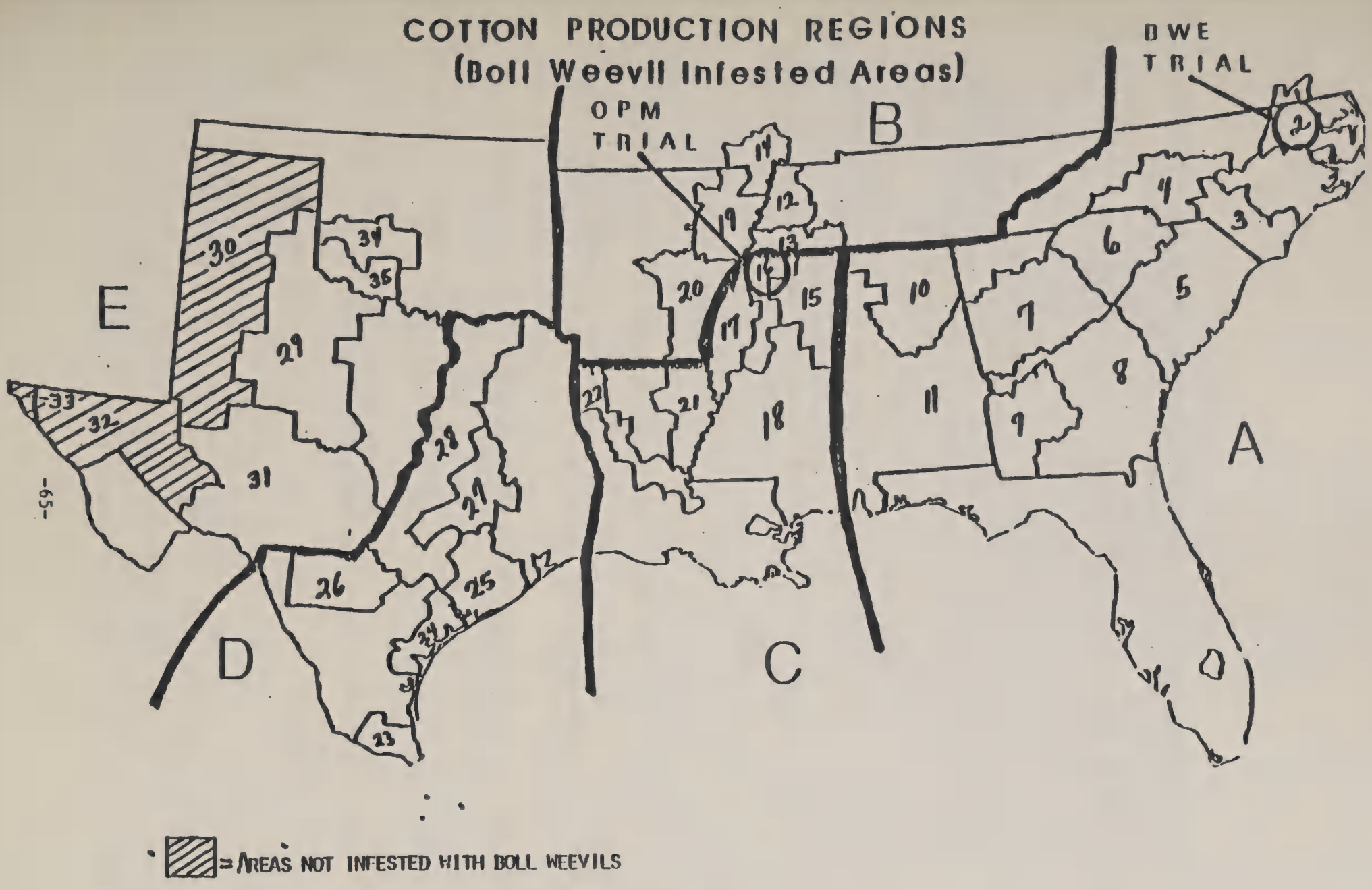

COTTON PRODUCTION REGIONS
(Boll Weevil Infested Areas)
BWE
TRIAL
OPM
TRIAL
A
B
C
D
E
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33
34
35
= AREAS NOT INFESTED WITH BOLL WEEVILS

FIGURE 1

5. Baseline yields associated with CIC are based on average 1969-78 yields as estimated by the Crop Reporting Service.

6. All program specifications and costs for year 1 of each program are to be based on normalized (5-10 year average) infestation level of weevils and other cotton insects.

7. Assume a common constant-technology base for all programs. Include only insect management technologies that have been tested and are recommended or available for use in 1980. Do not base your estimates of insecticide use or yields on projected future or near-known technologies. However, estimates should reflect changes in rates of adoption of base technologies as a result of additional Extension personnel and support.

8. Estimate costs of programs in 1979 dollars. Do not reflect any forecast of changes in price levels during the implementation period.

9. Specify program components and costs for each year during program implementation and following implementation to the point at which adjustments to the program are complete and costs and benefits are stabilized.

10. Quantify cost estimates to extent possible to facilitate review and updating.

11. Exclude all research and development costs, and all past or "sunk" costs.

12. Regular County Extension staff is not included in the computation of program costs. However, County Extension entomologists are included if assigned specifically to cotton.

13. Personnel guidelines for OPM are based on a general guideline of one entomologist per 30,000 acres, depending on the area and workload.

14. Public (CES) costs are expected to be about the same for OPM-NI and year 4 of OPM-PI and for the OPM-NI component of OPM-NI-BWE.

15. Incentive payments will be determined on the basis of Delphi estimates of diapause and pinhead square treatments for respective OPM options.

OPM Technical Components

Some of the technologies and practices to be used in implementing an OPM option are common among all States while others vary by State. Each State plan contains modifications as needed for implementation in that State. Key measures in an OPM option that are common to all States include population monitoring through scouting or field inspection, the use of traps for surveillance, and in-season boll weevil control based on State recommendations. Virtually 100 percent of the cotton acreage in weevil-infested areas would be scouted at least once a week in an organized OPM option.

A summary of differences in technical components for proposed State OPM options is provided in Table 1A. Cotton States in the Southeast will generally require an average of three diapause control treatments on a high percentage in the late summer and fall so that in-season insecticide treatments for boll weevil control would not be required prior to Heliothis pressure. In the Southwest, boll weevil suppression is commonly achieved by control of overwintered weevils with early-season insecticide treatments and with shorter-season or determinant varieties. Stalk destruction is voluntary in most areas but is mandatory in the Lower Rio Grande Valley of Texas. Recommended full and mid-season cotton varieties are recommended in the eastern States whereas the full range of varieties are recommended in Texas, depending on the particular region.

In some regions of the cotton belt, especially the upper mid-South, boll weevil populations are historically light and may not require control measures in some areas during most growing seasons. In these areas, the Modified Optimum Pest Management (MOPM) option would be implemented. Also, MOPM would be followed in areas heavily infested with boll weevils if the area-wide diapause technology could not be implemented.

A major cost component of all OPM programs is the personnel needed to carry out the respective program activities. The number of professional and technical personnel related costs are shown in Table 2A by States and regions. Currently, 77 professional and technical insect management specialists are assigned to the CIC program. To effectively carry out the components of the beltwide OPM program, an additional 173 persons would be required for a total of 250 cotton insect management specialists.

Cost Estimates

The average annual insect management program costs per cotton acre for CES activities are shown in Table 3A. Costs for the CIC program varied widely by State from 12 cents per acre in Arkansas to 83 cents per acre in North Carolina. These costs depend on many factors, some of which include the relative importance of cotton, the location and intensity of production and the intensity of insect infestation. The costs for OPM-NI varied from 42 cents per acre in Missouri up to $1.95 per acre in South Carolina. Most States estimated the alternative program costs at the State level rather than at the regional level, which accounts for average costs being identical across regions in some States. OPM-PI program costs begin with the incentive payments in year 2 and are lower each succeeding year because the incentive payments for diapause and pinhead square treatments are phased out. OPM-I costs, in most cases, remain constant over time at year 2 levels, as incentive payments continue. Incentive payments vary according to expected producer participation and insect infestations. Extension activities in the OPM-NI-BWE program immediately prior to, during and after eradication are generally at the same level as that of the OPM-NI option. The CES activity in the CIC-BWE program is the same as in CIC, as no added Extension funding is provided.

Table 1A--Summary of Technical Components for Proposed OPM Programs, by States and Production Regions 1/

State	2/ Regions	Cotton Varieties	3/ Treatments for Over-wintering Weevil Control	4/ Diapause Control		Stalk Destruction
				Acres Treated	Number Treatments	
			-----No.-----	--%---	---No.----	
North Carolina	2,3,4	Full & Mid-Season	0	100	2.5-3.2	Voluntary
South Carolina	5,6	"	"	"	3.2-3.7	"
Georgia	7,8,9	"	As needed	"	3.2-3.7	"
Alabama	10,11	Full Season	"	0 100	0 2.2	"
Tennessee	12,13	Full & Mid-Season	0	51	3	"
Missouri	14	"	"	30	2.4	"
Mississippi	15,16, 17,18	Full Season	As needed	70-96	1.3-2.2	"
Arkansas	19,20	Full & Mid-Season	0	23-42	2.2-3.0	"
Louisiana	21,22	Full Season	"	96	2.0-2.3	"
Texas:						
Lower Rio	23	Full & Short Season	2.0-2.2	NA	NA	Mandatory
Lower Coastal Bend	24	Short Season	2.1	"	"	Voluntary
Upper Coastal Bend	25	"	2.0	42	1.9	"
Winter Garden	26	"	1.8	NA	NA	"
Central River Bottoms	27	Full & Short Season	1.6	"	"	"
Blacklands	28	Determinant	1.7	"	"	"
Rolling Plains	29	"	.7	25	2.4	"
Upper Concho	31	Determinant & Full Season	As needed	NA	NA	"
Oklahoma	34,35	"	"	23	2.0	"

1/ All State OPM plans include scouting at least once a week, traps for surveilance of boll weevil, and in-season boll weevil control based on State recommendations.

2/ For location of production regions, see Figure 1.

3/ Pinhead square treatments, based on Delphi estimates.

4/ Based on Delphi estimates for an effective OPM option. Modified Optimum Pest Management (MOPM) will not include organized, area-wide diapause control treatments for suppression of boll weevil populations.

Table 2A - CES Professional and Technical Personnel, Alternative Boll Weevil/Cotton Insect Management Programs 1/

State, Region and Item	CIC	OPM-NI	OPM-PI	OPM-I	OPM-NI-BWE 2/
North Carolina (2,3,4)					
Number Prof. & Tech.	2	3	3	3	3
Personnel cost ($ Thous.)	40	65	65	65	65
Cost per acre ($)	.66	1.08	1.08	1.08	1.08
All options include 1 Pest Mgt. Specialist (M.S. degree) and 1 Technician (2 year degree). OPM options include an area Entomologist (M.S. degree).					
South Carolina (5,6,)					
Number Prof. & Tech.	2.3	10	10	10	10
Personnel cost ($ Thous.)	82	221	221	221	221
Cost per acre ($)	.47	1.26	1.26	1.26	1.26
All options include 2 Ph.D. entomologists. The OPM options include 4 additional entomologists (M.S. degree) and 4 Technicians.					
Georgia (7,8,9,)					
Number of Prof. & Tech.	2.3	6.3	6.3	6.3	6.3
Personnel cost ($ Thous.)	84	180	180	180	180
Cost per acre ($)	.37	.79	.79	.79	.79
CIC includes 1 Ph.D. and 1 M.S. entomologist. OPM includes 2 Ph.D. and 2 M.S. entomologists, and 2 with 2-year certificates in agriculture.					
Alabama (10,11)					
Number Prof. & Tech.	11	20.75	20.75	20.75	20.75
Personnel cost ($ Thous.)	151	367	367	367	367
Cost per acre ($)	.34	.82	.82	.82	.82
Personnel breakdown:					
Project Leader (Ph.D.)	1	1	1	1	1
Area Entomologists (M.S.)	2	5	5	5	5
County Entomologist (BS-MS)	4	4	4	4	4
Technicians (BS)		5	5	5	5
Scout supervisors		6	6	6	6

Cont'd - CES Professional and Technical Personnel, Alternative Boll Weevil/Cotton Insect Management Programs 1/

State, Region and Item	CIC	OPM-NI	OPM-PI	OPM-I	OPM-NI-BWE 2/
Tennessee (12,13)					
Number Prof. & Tech.	2	5	5	5	5
Personnel cost ($ Thous.)	65	176	176	176	176
Cost per acre ($)	.19	.52	.52	.52	.52
Added OPM personnel would be BS-MS, preferably entomologists.					
Missouri (14)					
Number Prof. & Tech.	1	4	7(4)	7	4
Personnel cost ($ Thous.)	43	100	222	222	100
Cost per acre ($)	.15	.36	.79	.79	.36
Added OPM personnel would be, preferably, M.S. with entomology or IPM training and experience.					
Arkansas (North Delta) (19)					
Number Prof. & Tech.	2.75	17.5	21.5	21.5	17.5
Personnel cost ($ Thous.)	38	390	500	500	390
Cost per acre ($)	.08	.85	1.09	1.90	.85
Arkansas (South Delta) (20)					
Number Prof. & Tech.	2.75	14.5	18.5	18.5	14.5
Personnel cost ($ Thous.)	38	312	432	432	312
Cost per acre ($)	.08	.66	.92	.92	.66
CIC includes 1 Ph.D entomologist, while the balance are chiefly part-time B.S. technicians. OPM options include 3 Ph.D. entomologists, with the balance M.S. (preferably) or B.S. entomologists or biologists.					
Mississippi (Delta) (17)					
Number of Prof.	3	12-5	12-5	12-5	12-5
Personnel cost ($ Thous.)	96	420	420	420	420
Cost per acre ($)	.11	.47	.47	.47	.47
Mississippi (N. Central) (16)					
Number of Prof. & Tech.*	3.5	6-12	6-12	6-12	6-12
Personnel cost ($ Thous.)	120	244	244	244	244
Cost per acre ($)	.60	1.21	1.21	1.21	1.21

Cont'd - CES Professional and Technical Personnel, Alternative Boll Weevil/Cotton Insect Management Programs 1/

State, Region and Item	CIC	OPM-NI	OPM-PI	OPM-I	OPM-NI-BWE 2/
Mississippi (Northeast) (15)					
Number of Prof. & Tech.*	4.6	4-8	4-8	4-8	4-8
Personnel cost ($ Thous.)	126	156	156	156	156
Cost per acre ($)	1.33	1.65	1.65	1.65	1.65
Mississippi (Southern) (18)					
Number of Prof. & Tech.*	4.4	7-7	7-7	7-7	7-7
Personnel cost ($ Thous.)	95	313	313	313	313
Cost per acre ($)	.45	1.50	1.50	1.50	1.50

*When 2 numbers are separated by a hyphen, the first indicates professional and the second technical personnel. Technicians would be needed about 6 months per year.

Professional personnel would be M.S. or Ph.D. entomologists, depending on availability.

Louisiana (21,22)					
Number of Prof. & Tech.	5	18	18	18	18
Personnel cost ($ Thous.)	126	450	450	450	450
Cost per acre ($)	.25	.88	.88	.88	.88

CIC professional personnel includes 1 Ph.D., 3 M.S., and 1 B.S. entomologist. Additional personnel for OPM would likely be B.S. entomologists. Availability problems may require the hiring and training of biologists other than entomologists.

Texas: 3/					
No. state specialists	1	2	2	4	6(2)
Personnel cost ($ Thous.)	42	84	84	168	252

Texas State and area specialists are Ph.D. entomologists while county entomologists are M.S. (a few B.S.).

Texas/Lower Rio Grande (23)					
Area specialists (No.)	1	2	2	2	2(2)
Cost ($ Thous.)	42	84	84	84	84
County Entomologists (No.)	2	2	15(2)	15	15(2)
Cost ($ Thous.)	74	74	555	555	555
Total cost ($ Thous.)	116	158	639	639	639
Cost per acre ($)	.42	.57	2.29	2.29	2.29

Cont'd - CES Professional and Technical Personnel, Alternative Boll Weevil/Cotton Insect Management Programs 1/

State, Region and Item	CIC	OPM-NI	OPM-PI	OPM-I	OPM-NI-BWE 2/
Texas/Lower Coastal Bend (24)					
Area specialists (No.)	1	2	2	2	2(2)
Cost ($ Thous.)	42	84	84	84	84
Co. Ent. (No.)	2	2	6(2)	6	6(2)
Cost ($ Thous.)	74	74	222	222	222
Total cost ($ Thous.)	116	158	306	306	306
Cost per acre ($)	.98	1.33	2.57	2.57	2.57
Texas/Upper Coastal Bend (25)					
Area specialists (No.)	0	1	1	1	2(1)
Cost ($ Thous.)	0	42	42	42	84
Co. Ent. (No.)	2	2	4(2)	4	5(2)
Cost ($ Thous.)	74	74	148	148	185
Total cost ($ Thous.)	74	116	190	190	269
Cost per acre ($)	.83	1.29	2.12	2.12	3.00
Texas/Winter Garden (26)					
Area specialists (No.)	1	1	1	1	2(1)
Cost ($ Thous.)	42	42	42	42	84
Co. Ent. (No.)	1	1	2(1)	2	1
Cost ($ Thous.)	37	37	74	74	37
Total cost ($ Thous.)	79	79	116	116	121
Cost per acre ($)	3.87	3.87	5.68	5.68	5.93
Texas/Central River Bott. (27)					
Area specialist (No.)	1	1	1	1	1
Cost ($ Thous.)	42	42	42	42	42
Co. Ent. (No.)	0	0	1(0)	1(0)	2(0)
Cost ($ Thous.)	0	0	37	37	74
Total Cost ($ Thous.)	42	42	79	79	116
Cost per acre ($)	.88	.88	1.65	1.65	2.43
Texas/Blacklands (28)					
Area specialists (No.)	2	2	2	2	4(2)
Cost ($ Thous.)	84	84	84	84	168
Co. Ent. (No.)	5	7	8(7)	10	16(7)
Cost ($ Thous.)	185	259	296	370	592
Total cost ($ Thous.)	269	343	380	454	760
Cost per acre ($)	.56	.71	.78	.94	1.57

Cont'd - CES Professional and Technical Personnel, Alternative Boll Weevil/Cotton Insect Management Programs 1/

State, Region and Item	CIC	OPM-NI	OPM-PI	OPM-I	OPM-NI-BWE 2/
Texas/Rolling Plains (29)					
Area specialist (No.)	1	2	2	2	3(2)
Cost ($ Thous.)	42	84	84	84	126
Co. Ent. (No.)	4	4	15(4)	15	30(7)
Cost ($ Thous.)	148	148	555	555	1,110
Total cost ($ Thous.)	190	232	639	639	1,236
Cost per acre	.16	.19	.53	.53	1.02
Texas/Concho Basin (31)					
Area specialist (No.)	1	1	1	1	1
Cost ($ Thous.)	42	42	42	42	42
Co. Ent. (No.)	3	3	5(3)	5	7(3)
Cost ($ Thous.)	111	111	185	185	259
Total cost ($ Thous.)	153	153	227	227	301
Cost per acre ($)	1.16	1.16	1.72	1.72	2.28
Oklahoma (34 and 35)					
Number of Prof. & Tech.	2	7	7	7	7
Personnel cost ($ Thous.)	53	162	162	162	162
Cost per acre ($)	.11	.34	.34	.34	.34

All options include 1 Ph.D. and M.S. entomologist. Added personnel for OPM options would be preferably B.S. or M.S. entomologists.

1/ Personnel costs include professional, technical and support personnel. Number within parentheses indicates manpower level in year 5, following implementation after the program has stabilized.

2/ Includes CES personnel only.

3/ Texas estimates include travel and support costs.

Note: CES personnel cost for CIC-BWE is the same as that for CIC.

Table 3A--Average Annual Cooperative Extension Service (CES) Program Costs Per Acre, Alternative Boll Weevil/Cotton Insect Management Programs, By Regions and States 1/

State and Region 2/	CIC	OPM-I 3/	OPM-PI 4/		OPM-NI 5/	OPM-NI-BWE 6/		CIC-BWE 7/
			Year 2	Year 5+		Year 2	Year 5+	
North Carolina	.83	10.08	10.08	1.37	1.37	1.34	1.34	.83
North (2)	.83	9.45	9.45	1.37	1.37	1.34	1.34	.83
South (3)	.83	10.24	10.24	1.37	1.37	1.34	1.34	.83
Piedmont (4)	.83	11.96	11.96	1.37	1.37	1.34	1.34	.83
South Carolina	.57	12.96	12.96	1.95	1.95	2.42	1.95	.57
Coastal (5)	.57	13.01	13.01	1.95	1.95	2.42	1.95	.57
Piedmont (6)	.57	12.54	12.54	1.95	1.95	2.42	1.95	.57
Georgia	.54	13.36	13.36	1.40	1.40	1.40	1.38	.54
Piedmont (7)	.54	11.99	11.99	1.40	1.40	1.40	1.38	.54
East (8)	.54	13.32	13.32	1.40	1.40	1.40	1.38	.54
Southwest (9)	.54	13.71	13.71	1.40	1.40	1.40	1.38	.54
Alabama	.37	3.74	3.74	.99	.99	.99	.99	.37
Limestone Valley (10)	.37	.99	.99	.99	.99	.99	.99	.37
South (11)	.37	7.71	7.71	.99	.99	.99	.99	.37
Tennessee (12, 13)	.23	5.30	5.30	.68	.68	.68	.68	.23
Missouri (14)	.19	3.09	3.09	.42	.42	.42	.42	.19
Mississippi	.37	4.51	4.51	1.15	1.11	1.15	1.11	.37
Northeast (15)	1.55	6.82	6.82	2.62	2.42	2.64	2.42	1.55
North Central (16)	.69	6.23	6.23	1.76	1.70	1.76	1.70	.69
Delta (17)	.13	3.11	3.11	.64	.64	.64	.64	.13
South (18)	.54	7.82	7.82	2.08	1.96	2.09	1.96	.54
Arkansas	.12	3.00	3.00	.91	.91	.91	.91	.12
Northeast (19)	.12	2.26	2.26	1.01	1.01	1.01	1.01	.12
Southeast (20)	.12	3.72	3.72	.80	.80	.80	.80	.12

Continued---------

Table 3A--Average Annual Cooperative Extension Service (CES) Program Costs Per Acre, Alternative Boll Weevil/Cotton Insect Management Programs, By Regions and States 1/ (Continued)

State and Region 2/	CIC	OPM-I 3/	OPM-PI 4/		OPM-NI 5/	OPM-NI-BWE 6/		CIC-BWE 7/
			Year 2	Year 5+		Year 2	Year 5+	
Louisiana	.30	8.39	8.39	1.20	1.20	1.20	1.20	.30
Northeast (21)	.30	8.52	8.52	1.20	1.20	1.20	1.20	.30
Red River Valley (22)	.30	7.63	7.63	1.20	1.20	1.20	1.20	.30
Texas	.45	4.62	4.54	.89	.89	1.93	.89	.45
Lower Rio Grande (23)	.43	7.21	7.17	.94	.94	2.74	.94	.43
Lower Bend (24)	.99	8.83	8.79	1.70	1.70	3.02	1.70	.99
Upper Bend (25)	.84	11.27	11.22	1.66	1.66	3.45	1.66	.84
Winter Garden (26)	3.89	11.41	11.41	4.24	4.24	8.18	4.24	3.89
Central River Bottom (27)	.90	4.73	4.69	1.14	1.14	2.87	1.14	.90
Blacklands (28)	.57	4.09	3.89	1.08	1.08	2.01	1.08	.57
Rolling Plains (29)	.17	3.57	3.53	.56	.56	1.47	.56	.17
Upper Concho (31)	1.18	1.25	1.25	1.25	1.25	1.25	1.25	1.18
Oklahoma (34, 35)	.15	2.28	2.28	.40	.40	.40	.40	.15
11-State Average	.35	4.94	4.92	.96	.95	1.31	.95	.35

1/ Includes all Cooperative Extension Service program costs including incentive payments, divided by average 1974-78 cotton acreage. Excludes insect control costs paid by producers.

2/ Location of regions is shown in Figure 1.

3/ Represents full implementation costs in year-2, allowing a 1-year buildup of resources.

4/ Year-2 represents the first year of full implementation of OPM-PI, following a 1-year buildup of resources. Public costs drop during years 3 and 4 as incentive payments are phased out. Year-5 cost levels represent continuing CES costs of the program.

5/ Reflects cost levels in year-2 and thereafter, following year-1 buildup of resources.

6/ Includes only CES program costs and excludes eradication operations (APHIS) costs. Year 2 represents full implementation of CES activities, following a one-year buildup of resources. In most States, the CES cost is equal to that of OPM-NI, while some States, especially in year-2, the year immediately preceeding eradication, have specified additional resources for the early years of the program. Following eradication, all States drop back to the OPM-NI level of funding. Calendar years of implementation differ among regions and States. Tables 7 and 8 indicate the correct sequence of years.

7/ Assumes no additional funding of CES activities associated with the eradication program. CIC funding is level over all years.

DESCRIPTION OF STATE OPM PLANS

FOR

BOLL WEEVIL INFESTED AREAS

A detailed description of OPM plans for each State follows:

NORTH CAROLINA OPM PLAN

The following North Carolina Optimum Cotton Pest Management Plan (OPM-NI) will serve as a baseline for comparison with the other management options (OPM-I, OPM-PI, and OPM-NI-BWE). These differences are discussed at the end of this report and reflected in various tables.

Emphasis in this OPM plan has been placed on population monitoring of key pest species, integration of the other disciplines with cotton insect management, and the enhanced implementation of the overall cotton management program via expansion of the existing extension informational and educational programs.

Although optimum insect management, particularly of the boll weevil, is the focal point of this document, management of this and other pests influences and is influenced by other cotton production practices. Because the status of various species and production inputs are dynamic, the OPM plan described herein will be modified periodically to reflect these changing conditions. Also, various shorter season cotton production parameters are now being evaluated in North Carolina as potential inputs into our overall cotton management system. As these options and their interactions with each other and current management practices are understood and incorporated a shorter season alternative, their inevitable effect on the population dynamics of the various pest species can also be expected to modify the management system described herein.

I. Optimum Pest Management Struccture

A. Area

1. Delineation - North Carolina's cotton acreage can be conveniently divided into two ecologically distinct pest management districts. These two areas roughly coincide with the present boundaries of the Boll Weevil Eradication Trial Program except Harnett, Sampson, and Cumberland counties are now included in the southern region (see appended map): the northeastern part of North Carolina (called NC North herein) occupying the cotton acreage lying approximately north and east of Fayetteville, North Carolina, and a southern area (called NC South herein) composed of North Carolina's remaining cotton acreage. Both areas contained approximately 20,000 acres in 1979. Although the cotton acreage of our western Piedmont falls outside of the Trial area and is ecologically more similar to the northern area, this acreage is too small (less than 3,000 acres) and remote to be considered as a separate unit.

2. General Pest Status - Insect management in North Carolina within the past ten years has revolved mainly around one pest and one pest complex, the boll weevil and the Heliothis complex. The boll

weevil, until approximately 1974, had been North arolina's most economically important insect pest. Since then, it has relinquished that status to the bollworm and tobacco budworm, Heliothis zea and H. virescens. With more selective insecticides now available for Heliothis species control, often used on a wider application schedule, the boll weevil has the potential to regain at least part of its former status as a serious economic pest.

Several additional lepidopterous pests which are at times damaging to cotton in North Carolina are the cabbage looper, the European corn borer, and the beet and fall armyworms. Damage by the latter two species is far more prevalent in the southern than in the northern area. Economic damage from thrips, aphids, cutworms, spider mites, and other miscellaneous arthropods is either sporadic, minimized by an in-furrow systemic insecticide, or incidentally suppressed by the control of other insect species.

B. Personnel

Our current cotton pest management project employs one cotton extension entomologist and one agricultural technician. They are responsible for the implementation of a statewide cotton insect management program. The addition of one area cotton entomologist is envisioned. This person would be assigned to the 20,000 acres within the northern area. Because most of this acreage is organized into community cotton insect management groups, most of this individual's time would be utilized in assisting these grower groups with their insect management decisions. This person would be responsible for all population monitoring in the northern area (detailed under Part III). The individual's program would be coordinated with those of the cotton pest management specialist and our county agents.

Most cotton scouts and scout supervisors in North Carolina are trained by our project. Cotton scouts and scout supervisors are paid entirely out of grower funds. Our project designs and provides field cards, scouting forms, and scouting manuals to all scouts, scout supervisors, and other interested parties and will continue to fulfill this function in an OPM program.

Specialists from other departments such as Crop Science, Plant Pathology and Economics interact with our project and help develop our overall cotton production system.

C. Educational Programs

1. Producer Meetings - With approximately 400 cotton producers in North Carolina, the combination of extension and industry grower meeting has served and will likely continue to serve as viable on-going means of exposure to cotton pest management principles for many of our producers.

2. Community Group Meetings - Our project personnel are routinely called to meet with community cotton pest management groups both during the winter months and throughout the growing season.

3. Cotton Insect Management Newsletter - This newsletter is mailed to all North Carolina cotton producers, plus other interested parties to inform them to expected insect conditions, insect management principles, and other timely information. Under the proposed OPM situation, a greater emphasis would be placed on educating our growers on the idea and implementation of an integrated, interdisciplinary approach to cotton production. Information about the status of boll weevil based upon pheromone trapping in the various regions would be provided, and cotton producers informed of community and local diapause control plans (See IV, D, 1 c).

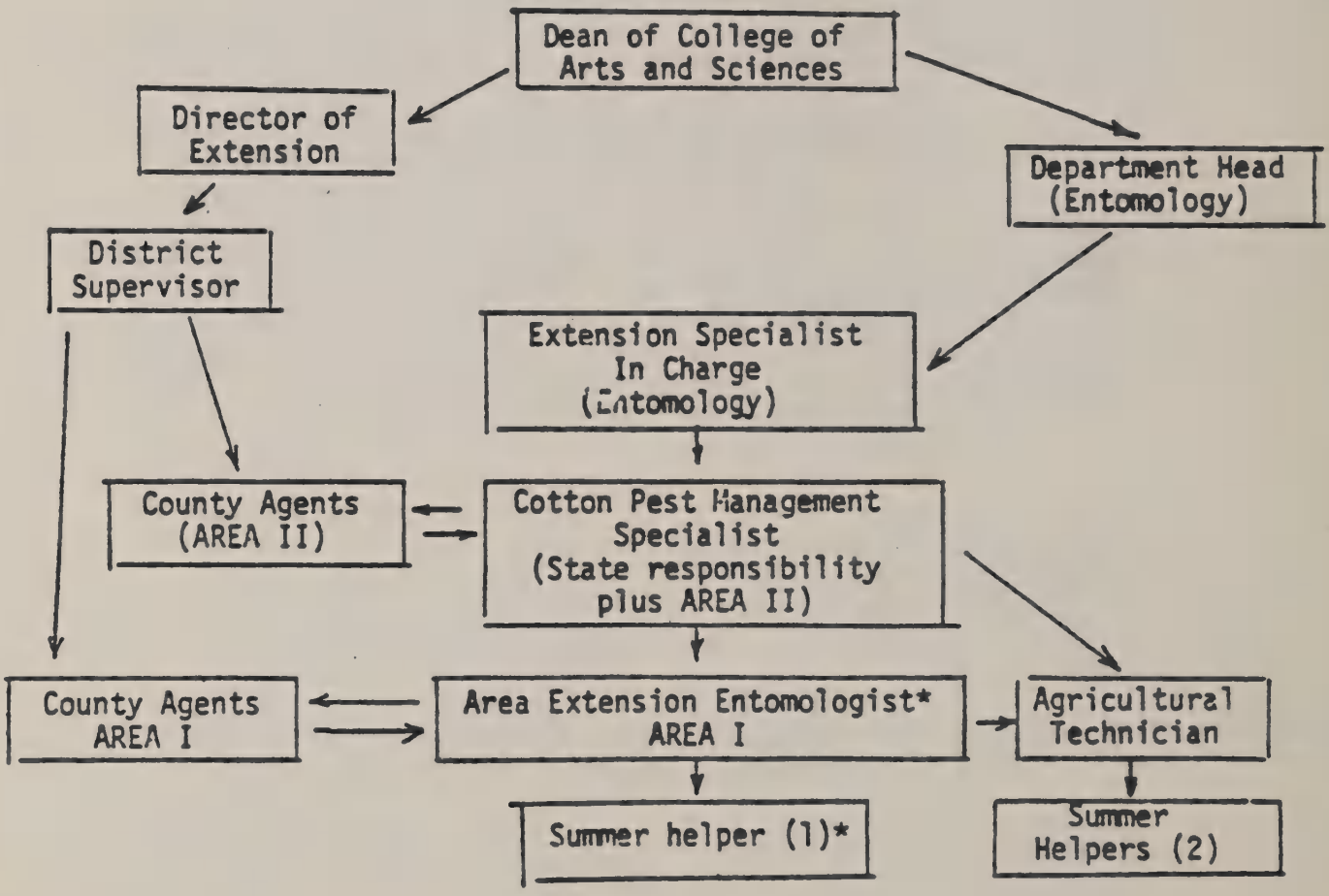
4. Teletip Pest Alert - Presently, 17 of our project's 20 black light traps feed adult Heliothis zea moth counts into a recording system which is integrated with other pest information and available biweekly through a toll free number. Our OPM plan calls for six additional black light traps to plus into the Pest Alert System.

5. Scouting Schools - Scouting schools will continue to provide most of our state's scout training under an OPM plan.

6. Additional Educational Outlets - Our traditional educational outlets such as direct grower contact, agent training, newspaper articles, and radio tapes will be continued under an OPM program.

D. Communication

A simple diagram of the organization of the personnel involved in the OPM cotton management program is shown on next page.



*Additional personnel to be hired under OPM program.

Although the extension cotton pest management specialist in entomology answers indirectly to the department head, he answers directly to the specialist in charge for program direction and in most extension matters. The proposed area cotton entomologist, as mentioned in I, B, would coordinate his activities with those of the cotton pest management specialist and work largely through county agents. The agricultural technician, although reporting directly to the cotton pest management specialist, would also support the area entomologist, especially in the setting up and implementation of insect management demonstrations and farm tours. Both would employ a limited number of summer helpers.

II. Cultural Practices

A. Seedbed Preparation

Subsoiling and bedding will continue to be recommended. These agronomic practices are compatible with both our current cotton production system and a potential shorter season approach.

B. Fertility

Soil samples will continue to be the recommended basis for nutrient additives, particularly N, P, K and Boron. A shorter season cotton production system may incorporate nitrate monitoring via petiole analysis if current research shows this to be a viable production practice in our area.

C. Varietal Selection

Shorter season varieties are now being recommended in North Carolina such as McNair 220 and 235 and Coker 304 and 310. This will likely continue to be the case.

Although varieties are currently being developed and even recommended in some areas with varying degress of nematode and insect resistance, presently researched varieties have either not lived up to resistance expectations or suffer from significant yield reductions under North Carolina conditions.. If and when new varieties are available that offer North Carolina producers an economic advantage over those presently recommended, these varieties will be recommended by us.

D. Trap Crops

Because of our short growing season, our producers plant cotton as soon as soil conditions are acceptable. Trap cropping as a means of attracting and eliminating overwintered boll weevils is not a viable practice in North Carolina.

E. Planting Dates

Because cotton requires a long growing season, it must be planted relatively early in the spring when conditions are often not optimum for its germination and early growth. Slow early growth makes cotton more susceptible to attack from disease organisms and less competitive with weeds. Cotton planted later in the spring is often more susceptible to late-season insect pressure and early frosts. Our recommended planting dates are mid-April and mid-May; the planting date chosen by the producer is considered a calculated risk. However, planting on the early side of the recommended range on well-drained soil can better his odds.

F. Plant Density

A low plant density (2-4 plants per foot) is generally recognized as minimizing vegetative growth and enhancing crop maturity. In North Carolina, cold, wet springs often threaten plant stands, and a low seeding rate can be risky under these conditions. Research in our area on the effect of stand density on cotton crop maturity has not consistently supported the relationship between low stand density and increased crop maturity. A more reliable relationship between stand density and crop maturity must be substantiated before low plant densities resulting from low seeding rates can be recommended.

G. Weed Management

Our recommended weed management program involves all methods of weed control including crop rotation, crop competition, cultivation and the selective use of herbicides. Those weed management practices which encourage crop maturity will be recommended; those which increase insent pest problems will be discouraged. Fall weed mapping as a planning base for pinpointing the following year's weed management program will be encouraged. The negative interaction between certain preplant herbicides and soil applied systemic insecticides on plant growth are now at least partially understood. The herbicide and insecticide combinations resulting in these plant delaying and stunting effects will be discouraged.. Unless the tradeoff (greater yield loss through weed competition than by insect damage) dictates otherwise, over-the-top applications of arsenicals will be either avoided or made with a knowledge of their potential adverse effect on beneficial insects.

H. Nematode, Disease Management and Stalk Destruction

Nematode management in North Carolina is based upon both cultural and chemical control practices. Cotton stalks should be cut in the fall

and then disced or plowed out. This practice will help eliminate living roots needed for the continued reproduction and survival of nematodes and also help expose the nematodes to the killing action of cold weather. Crop rotation is also an important component of a nematode management system. Growing a nonhost crop in the rotation prevents the reproduction of nematodes. Peanuts are an excellent crop to grow in rotation with cotton. Small grains and most other grass-type crops are also suitable. Corn will not reduce population levels of root-knot nematodes, but is a better option than growing continuous cotton. Resistant varieties are also important in nematode management. Most of our currently reccommended varieties planted in North Carolina have a moderate degree of resistance.

North Carolina growers will be advised of the potential adverse effects of soil-applied contact nematicides on beneficial insects and the resulting potential increase of cotton bollworm and tobacco budworm problems.

I. Growth Regulators

Growth regulators are currently being intensively research as a potential management option in North Carolina, Pix® would seem to be compatible with a shorter season cotton production system, particularly in areas with a high probability of rank, vegetative growth. If further research demonstrates a consistent positive benefit/cost ratio, then growth regulators may be recommended. The addition of a growth regulator can be expected to change other management inputs.

J. Irrigation

Although irrigation is not a presently recommended practice, several research plots are planned to investigate this option, especially in combination with the growth regulator Pix®.

K. Defoliation and Harvest

Although extension recommendations call for defoliation when approximately 80% of the bolls are open, this practice is normally left to producer discretion.

As a part of a fall diapause program for boll weevil management, a boll weevil insecticide such as malathion or Guthion will be recommended as an addition to the defoliate.

Because cotton producers must base their time of harvest on many considerations, including weather and the harvest of other crops, our

project's recommendation is simply a general one which encourages that harvest be completed as early as possible to complement a fall diapause schedule (if one is needed), stalk destruction distribution, and the discing or plowing of residues.

III. Detection and Surveillance

A. Grandlure Baited Traps

Our project's historical (1976-1979) practice utilizing pheromone traps as a basis of delineating spring and fall boll weevil populations will be greatly expanded under an OPM plan. One trap per 200 acres is planned. A combination of project, county agent, and community group help will be utilized in trap checking, both in the spring (mid-May through June 15) and fall (September 15 through November 15). Spring trapping will serve as the basis pin square applications and the fall trapping program will aid in the planning and evaluation of a fall diapause program. Traps and pheromone will be paid for from project funds to ensure involvement of all cotton acreage.

B. Zealure-Virelure Baited Traps

Black light traps will serve as monitoring devices for Heliothis zea; therefore, the use of zealure traps is not planned. The utilization of 20-25 virelure traps is planned, one in the vicinity of each black light trap to facilitate trap checking for both Heliothis zea and virescens.

C. Black Light Traps

The addition of 10 black light traps, in addition to the 20 already operative, should provide a sound monitoring tool for the timing and relative magnitude of our major Heliothis zea moth flights under an OPM system. This would provide approximately 1 trap per 2,000 acres under our anticipated cotton acreage. These traps are not considered a substitute for scouting, only a means of alerting scouts and growers of our major flights so that scouting efforts can be intensified.

D. Monitoring of Adjacent Hosts

Most of our bollworm damage is the result of Heliothis zea. In North Carolina, nearly 2,000,000 acres of untreated field corn serve as a springboard for the vast majority of our H. zea adults. Corn is routinely monitored throughout the state by our survey entomologist. This monitoring provides a valuable early indication of H. zea population levels.

E. Modeling and Weather Monitoring

North Carolina State University, in cooperation with the North Carolina Department of Agriculture, is presently phasing in a network of approximately 14 weather stations throughout the state. This climatological data will be more sophisticated than that now available at our experiment stations. One emphasis will be the availability of this data for use in pest management systems development and implementation. This weather data could be expected to impact our OPM project in the future.

The Heliothis model developed at North Carolina State University was one of the first and is perhaps the most sophisticated in the United States. Parameters of a complex, multicrop nature and their interactions will be used to predict various man-induced agronomic changes and their effect on various agroecosystems, including cotton.

IV. In-Season Insect Management

A. Thresholds

Our tresholds have been chosen to represent levels at which a treatment is justified under most circumstances.

1. Boll Weevil - If the percentage of egg punctured squares (either egg or feeding) by boll weevils reaches 10%, then treatment with a recommended insecticide is usually justified. If the boll weevil thresold is met within three weeks prior to our major bollworm moth flight and significant egg laying by these moths occurs and if a treatment is made with an insecticide which destroys the beneficial insect complex, growers and agents should be aware that increased survival of bollworm egg and small larvae may result.

   The possible use of Dimilin® in an OPM program would employ an entirely different strategy which will be discussed under D, 4.

2. Bollworms - The currently recommended threshold for a bollworm egg insecticide (or Ovicide) is somewhat arbitrary. If a level of 40 eggs per 100 terminals is reached, a recommended ovicide may be considered. Beneficial insects may provide adequate suppression of these eggs and small larvae to ride out this period, at least temporarily. However, switching to a larvicide is indicated when one of the following larval criteria has been met:

   a. Prebloom cotton
      (1) 7-8 larvae per 100 terminals, or
      (2) 5-6 larvae per 100 squares, 94
      (3) 15% damaged squares.

A synethetic pyrethroid is normally recommended in this early season spray situation.

b. Blooming cotton

(1) 3 live worms per 100 terminals or squares, or
(2) 5% squares or young bolls damaged.

The above rcommended thresholds are general guidelines, and various circumstances may require some departure. For example, if a weekly scouting routing is being followed, then management decisions must be more conservative than under a twice-per-week scouting regime baecause of a greater period of time in which the population level is not known. An experienced decisionmaker may be able to tolerate a few more small bollworms in plant terminals if scouting frequency is every 2 or 3 days, and beneficial insect levels are high. The greater the degree of uncertainty of the insect poplations, the more conservative the management approach required.

B. Insect Scouting

The "scouting" of cotton for insects and their damage is the mainstay of an insect management program. Scouting is a statistically based, systematic means of monitoring cotton on a regular basis in order to make economically sound insect management decisions. Although the scouting of cotton for our major insect pest species is emphasized herein, scouting time can be utilized ore effectively if cotton plant growth and square retention, weed populations, diseases, and other factors which affect crop development are concurrently monitored.

Scouting for the boll weevil in North Carolina is initiated at the "pinhead" square stage when the cotton plant is beginning to produce squares (flower buds) the size of a kitchen match head. At this stage the squares are large enough for the female boll weevil to insect, or oviposit, her eggs. One hundred squares are picked randomly by walking diagonally or in a zigzag manner across the field of 20 acres or less. The picking of flared squares is always to be avoided because these squares have an unrepresentatively higher damage level than actually exists in the field as a whole. In fields of more than 20 acres, the square sample should be larger. Scouting for the boll weevil should continue on at least a weekly basis throughout the season until either the first killing frost or stalk destruction.

If the boll weevil pheromone traps (mentioned earlier) placed throughout a wide geographic area indicate extremely low population levels of boll weevils, early scouting for boll weevils levels may not be necessary. However, because boll weevil levels can build quickly

during the growing season under favorable circumstances (such as rainy weather and light insecticide pressure), late season scouting should always include monitoring for weevils.

Most scouting in North Carolina revolves around the Heliothis complex, although other potnetial insect and mite pests in addition to the boll weevil are also monitored. In the northern North Carolina counties, regular scouting for Heliothis and other lepidopterous pests begins approximately early to mid-July. Heliothis zea larvae, the major northern economically damaging species, occur primarily on field corn during its first two generations. The third generation of moths usually emerges in large numbers from mid-July to early August, a time when corn is drying, leaving blooming cotton as an attractive host. Initial scouting usually encompasses the inspection of 100 random cotton plant terminals for eggs and small larvae and, additionally, 100 squares for live bollworms and their damage. The same diagonal or zigzag pattern is employed as was mentioned earlier. Later in the season, scouts alter their monitoring procedures to reflect the more advanced phenology of the cotton plant and inspect a combination of 100 squares and bolls for damage and live worms. The monitoring of bolls is intended to reveal worms which either survived earlier insecticide treatments or those derived from eggs laid further down the plant on squares, stems and blooms. The significance of this latter pheomenon in some years is appreciable, especially during dry weather. Also, as the season progresses, egg laying will occur lower on the plant. Routine scouting should include enough whole plant examinations for eggs and small larvae to discover if eggs are being deposited lower on the cotton plant.

Souting on a weekly basis is adequate until an increase in egg laying is noted. Scouting at this point should be conducted twice per week until the onset of regular insecticide treatments. Thereafter, weekly scouting for the remainder of the season will usually suffice.

In our southern counties, scouting is done in the same manner but is more complex. Not only does the major Heliothis generation occur approximately 1 to 2 weeks earlier, but also the previous generation can cause economic damage, sometimes in mid- to late June. Also, the tobacco budworm usually makes up a greater percentage of the cotton bollworm complex than is the case further north. The tobacco budworm is the more difficult to control of the two. Beet and fall armyworms are more prevalent in the southern than in the northern counties; both species can cause economic damage to cotton. These armyworms are very similar in appearance to both members of the Heliothis complex. Accurate identification of these species can be critical because some chemicals are effective against the armyworms and ineffective against Heliothis and vice versa.

When the bolls which the grower expects to harvest are difficult to cut through with a pocket knife (approximately 3-4 weeks, depending upon temperature), the bolls are normally impervious to bollworm and other insect attack. At this time, scouting for insects and their damage may be stopped. Continued spot scouting for boll weevils is a sound practice, however. Although boll weevils found after routine scouting has been discontinued will not damage the current year's crop, the scout and grower can gain a rough appreciation of potential boll weevil problems to next year's crop at this time.

C. Conservation of Beneficial Arthropods

All cotton production practices will be geared toward conserving the beneficial arthropod complex as much as possible.

D. Insect Management by Crop Phenology and Insecticides

1. Early-Season Insect Management - Early season management, as the name implies, revolves around controlling pest species which are pests on preblooming cotton. In applying pest management principles to cotton, the use of preventative treatments is discouraged . . . usually. The one exception to this is an in-furrow application of a systemic insecticide. At the recommended rates, this treatment can: (1) control early season pests, such as aphids and thrips, and (2) enhance the maturity of the cotton plant. Scouting for these very tiny early season insects is not practical, and this systemic insecticide treatment lasts for up to six weeks. At higher rates, this application can initiate early bollworm outbreaks by the first two generations, which are normally kept below economically damaging levels by beneficial insects.

2. Mid-Season Insect Management - Mid-season management begins when the bollworm or tobacco budworm becomes an economic problem. The third generation bollworm moths (Heliothis zea) from the ears of field corn are usually the first ones causing major damage on cotton in North Carolina (although the tobacco budworm is sometimes our first economically damaging pest in our southern counties). Beneficial insects also play such an important role against this generation. Applications of some recommended bollworm materials applied too early not only delay maturity and add expense but also kill the beneficial insect complex, allowing subsequent egg hatch to occur almost unimpeded. Applications applied too late can result in larvae too large to control effectively. Thus, exact timing is imperative.

   In the southern counties, insecticide applications are sometimes needed for an earlier bollworm generation. This practice is justified at times but is generally discouraged. Cotton at this time

has not yet begun to set bolls and can compensate somewhat for the loss of these early squares. This is why our prebloom thresholds are higher than after boll development has been initiated. This early damage is often caused by the tobacco budworm, which is more difficult to kill than the corn earworm. Additionally, as stated before, these early applications with most of our recommended bollworm chemicals can trigger later bollworm control problems. Early applications of the organophosphate class of insecticides cause a delay in the maturity of the cotton plant.

However, occasional early insecticide applications are justified. The protection of early fruit can affect the physiology of the cotton plant permitting energy uptake by the young bolls which acts to suppress vegetative growth, resulting in an earlier maturing cotton crop. The decision of whether or not to treat for this early bollworm damage is a difficult one which is often less clear-cut than the later season decisions already mentioned.

Mid-season control of boll weevils is accomplished concurrently with bollworm applications, since most of our bollworm insecticides adequately control boll weevils. However, not all bollworm insecticides are effective against boll weevils. Also, bollworm applications on a 7-day schedule will not be adequate to control an entrenched boll weevil population.

There is currently a trend away from this, however. As more specific bollworm materials become available which are effective against bollworms and less effective against the boll weevil, or if these materials are applied on a schedule wider than is necessary to control the boll weevil (3-5 days), the boll weevil can be expected to increase as an economic problem and strategies adjusted accordingly.

3. Late-Season Insect Management - Late-season insect management primarily revolves around two strategies: (1) the cessation of insecticide treatments just as soon as possible, and (2) the application of boll weevil diapause applications, if needed.

Probably too many late-season insecticide treatments are used against bollworms in North Carolina as a rule. When a boll is approximately three weeks old (three weeks past blooming), it starts to become fibrous and impervious to bollworm attack. Yet, many growers try to protect these bolls plus squares and blooms forming at a time when they would have virtually no change of being harvested. There is a trade-off, however, since these late unnecessary bollworm treatments also function as diapause applications against the boll weevil.

4. Boll Weevil Management - Potential pinhead square applications against the boll weevil's overwintered will be based on either very careful field monitoring or pheromone trap catches. If Dimilin® is competitive as an early season management strategy, insecticide applicaions must be based upon pheromone trap catches before the female boll weevils have a chance to initiate egg laying into squares.

   The use of this chemical in a typical grower situation must be demonstrated before we will recommend the use of Dimilin® as a routine management option.

   The focal point of our boll weevil management program will be encouraging growers to apply 2-4 diapause applications. This practice has consistently proven to be an effective management tool in significantly reducing potential overwintering populations when utilized on an areawide basis.

   These annual diapause applications, if done systematically on an as-needed basis, should result in population levels the following spring low enough to ensure bollworm management without interference from boll weevils in most areas.

V. Evaluation

Although not developed in detail, an annual evaluation will be undertaken to measure the anticipated benefits of a statewide OPM program. This evaluation will utilize randomly selected participating and nonparticipating growers and grower groups of a statistically valid sample size for comparison.

VI. Other Components

A. Advisory Committees

Our Extension Cotton Commodity Advisory Committee would periodically make recommendations to this project of an interdisciplinary nature. The various agricultural specialists in charge also form an Extension Advisory Committee for Pest Management. This committee is also expected to influence the OPM practices implemented.

B. Research

Our cotton research encomologist will continue to develop cotton pest management inputs applicable to an OPM program. Research from other scientists will also be routinely evaluated for possible use in our OPM program.

SOUTH CAROLINA OPM PLAN

SITUATION

In South Carolina pest management is part of the total cotton production system which is oriented toward achieving optimum yields. Control of insects, weeds and diseases accounts for an estimated 35% of the variable production costs. Insects have been tranditionally considered the primary pest of cotton production in South Carolina. Boll weevils, in the past have frequently required early insecticide controls which triggered earlier than usual outbreaks of bollworms (Heliothis spp.) and other pests.

The development of resistance to insecticides by Heliothis created many control problems when insecticides were used routinely. Resistance to commonly used insecticides may cause buildup of Heliothis spp. which oftentimes result in substantial yield reductions. Whenever a breakdown in insect control occurs during the critical fruiting period, a serious disruption in the cotton production program results which may cause yield losses. The proper use of proven insect management practices will substantially reduce early season insect control and Heliothis buildup. Many inherent insect problems will be corrected when an intensive insect management program is utilized by cotton growers on a community-wide basis.

I. Detection and Surveillance

A. Grandlure Baited Traps

The utilization of pheromone traps as a basis of delineating spring and fall boll weevil populations will be greatly expanded under an OPM plan. Traps will be used on a basis of four traps per cotton area or group of cotton fields. The traps will be installed in the spring around April 1 and checked weekly until around June 1. In the fall, traps will be checked weekly after installation around September 1 through November 1.

The traps will be maintained and checked through a combination of project, county agent and grower cooperative help. The information gathered will be used to determine the need for spring pinhead square application and fall diapause applications. Traps, pheromone and labor cost will be provided through project funds.

B. Heliothis Pheromone Traps and Light Traps

The bollworm complex, Heliothis spp. will be monitored using virelure and zealure baited traps and black light traps. Black light traps will be located at central trapping sites at strategic locations thoughout the cotton producing areas of South Carolina. Heliothis zea will be the primary insect monitored using the black light trap but other Lepidopterous insects such as Spodeptera exigua and Spodiptera frugiperda may be monitored.

Virelure and zealure baited traps will be used to detect population fluctuations of Heliothis virescens and H. zea respectively. These traps will be located throughout the cotton producing areas on an as needed basis. Heliothis pheromone trap catches will backup field scouting reports.

C. Monitoring of Adjacent Hosts

Adjacent host plants such as corn, soybeans, tobacco and sunflowers and wild host plants such as Carolina geranium, toadflax, lespedeza and others will be monitored to detect seasonal fluctuations in the Heliothis population and other pests that attack cotton. Information gathered will be used to fill gaps in the seasonal insect population pattern and for possible use in insect prediction models.

The models for cotton growth simulation and Heliothis population prediction will be examined for incorporation into the optimum pest management program. Their potential use would be to improve insect prediction, timing of insecticides and growth prediction.

D. Modeling

The Heliothis prediction model may be incorporated into the optimum pest management system if feasible. Information gathered from traps, alternate hosts and field scouting will be utilized as resource information.

II. In-Season Insect Management

A. Thresholds

The thresholds presented have been chosen to represent levels at which a treatment is justified under most circumstances.

1. Boll Weevil - If the percentage of punctured squares by boll weevils reaches 10 to 15% before bloom, then treatment with a recommended insecticide is usually justified. After bloom, treat if damage reaches 10%.

2. Bollworms - Before small bolls are set (around July 1) and in untreated fields, begin treatment when 6 to 7 small bollworm larvae are found per 100 plant terminals or 9 to 10% damaged squares. After small bolls are set or in previously treated fields, treat when 3 to 4 small larvae are found per 100 plant terminals or 5% square damage. Apply insecticides as needed on a 3-5 day schedule while bollworms are present. When 15 to 20 eggs or more are found and small bollworm larvae are not found, recheck fields in 2 to 3 days for newly hatched larvae and treat if threshold has been reached.

No absolute threshold exist for treatment of eggs using an ovicide. When 20 to 30 eggs are detected per 100 plant terminal application of an ovicide may be beneficial.

3. Plant Bugs - Treat when an average of one plant bug is found per row foot using a beat cloth. If 25% of pinhead squares have been lost, treat if an average of one plant bug is found per 2 row feet.

B. Insect Scouting

The scouting of cotton for insects and their damage provides growers the basic information upon which to make insect management decisions. Cotton growers in South Carolina utilize scouting extensively. Scouting services are provided through Extension programs, private consultants, industry, grower organizations and individual growers scouting their own cotton.

Scouting is started around the early squaring stage and continued through boll maturity. Generally, twice per week scouting is recommended over the once per week program. Twice per week scouting provides growers more timely information about bollworm moth flight and bollworm damage.

Scouting procedures require scouts to walk a zigzag pattern, figure 8 or another pattern to represent the field. The scouts examine 100 plant terminals and 100 squares per every 20 acres at random while walking the pattern. Squares are checked for bollworms, bollworm damage, boll weevil and boll weevil damage. The terminals are checked for bollworm larvae, bollworm eggs and plant bugs. In addition, scouts observe damage from trips, spider mites, aphids and other insects that may occur throughout the season. Plant bugs are monitored prior to first insecticide spray using a beat cloth to check six feet of row in four locations. Beet armyworm and fall armyworm occasionally attack cotton and scouts maintain close look after these insects throughout the season.

C. Conservation of Beneficial Insects

Conservation of beneficial insects will be stressed through continued recommendation of low rates of systemic insecticides to control thrips and aphids, encouraging directed use of herbicides, avoidance of early season insecticide application through alternate methods of weevil control (i.e. fall diapause control and pinhead square applications) and use of biological insecticides on low populations of Heliothis.

Early infestations of plant bugs, Lygus spp., and cotton fleahoppers, Pseudatomoscelis seriatus, will be monitored using field scouts and where damaging populations occur growers will be encouraged to use low

rates of insecticides for conservation of beneficial insects. Backup demonstrations on the efficacy of these low rates of insecticides will be demonstrated to encourage this practice.

D. Insect Management by Crop Phenology and Insecticides

1. Early-Season Insect Management

Early-season management revolves around controlling pest species which occur on preblooming cotton. Aphids and thrips are generally the major early season pest of cotton. These insects are usually controlled using in-furrow treatments of systemic insecticides. At the recommended rates, the systemic insecticides will control thrips and aphids, help stand development and enhance maturity. At higher rates, a risk of higher early season bollworm populations may develop which could require early insecticide treatment.

Overwintered boll weevil populations may be significant enough in certain areas to require a pinhead application of insecticide. The need for the pinhead square applications will be determined using pheromone traps to monitor overwintered weevil population levels. In general, if there is greater than 1.5 weevil per trap over a 4 week period an application will be recommended. Dimilin® may be incorporated into the weevil management program if feasible.

2. Mid-Season Insect Management

Mid-season insect management is considered to be after first bloom until boll maturity. Plant bugs normally occur after first bloom. The plant bug may cause serious damage to cotton if the right conditions are present. Low rates of recommended insecticides will adequately control plant bugs and conserve beneficial insects. The low rates are necessary because of the potential for possible outbreak from bollworms.

Bollworms control may be necessary from early bloom through boll maturity in certain areas of South Carolina. This situation is the result of high tobacco budworm populations that occur in late June and early July in certain areas. Most areas must apply insecticides beginning around mid to late July as a result of heavy cotton bollworm populations emerging from corn. Beneficial insects play an important role in suppression and control of the second generation of bollworms. The use of systemic insecticides, if excessive rates were used, may cause early problems with bollworms. The use of Chlordimeform as an ovicide and biological insecticides have potential to aid beneficial insects in suppression of early bollworm buildup from occurring.

Boll set is of prime importance since the growing season is slightly shorter in South Carolina. Applications of insecticides may be necessary to avoid excessive square loss which may result in vegetative growth. The proper timing of insecticides is of utmost importance since a poor choice of insecticide rate and time of application may create a situation where large bollworm larvae develop. Generally, the newer insecticides (permethrin, fenvalerate, and sulprofos) are preferred over methyl parathion combinations. Methyl parathion causes delayed maturity of the cotton crop and late harvest. A late crop may provide more favorable development sites for boll weevil since fruiting is prolonged. In addition, the tobacco budworm is very resistant to methyl parathion and has caused serious control problems in the past.

The presence of boll weevil and bollworm concurrently creates a difficult situation for cotton growers since the newer insecticides are not as effective as the methyl parathion combinations and other organophosphates. Additional insecticides must be added to the new insecticides for control of the boll weevil. Other alternatives for boll weevil control would be to use the new insecticides with old "standard" insecticides used during periods of lower bollworm pressure.

The use of information collected from light traps and pheromone traps would provide data on the relative abundance of cotton bollworm and tobacco budworm. The abundance of tobacco budworm is the primary factor affecting the choice of insecticides for overall bollworm control. The knowledge of budworm population would enable growers to incorporate bollworm control with boll weevil control. Insecticides could be selected that controlled cotton bollworm and boll weevil during low populations of tobacco budworm and oriented more toward tobacco budworms during their high populations.

3. Late Season Insect Management

Cessation of regular season normally occurs about August 30 in South Carolina. The normal boll set has become mature and is not susceptible to bollworm attack. The main insect of concern during late season is the boll weevil.

Boll weevil population will be monitored using pheromone traps. Fall diapause applications of insecticide will be recommended when significant populations occur. The suppression of weevil populations will be recommended when necessary during the regular season through integrated insecticide programs designed for optimum control of bollworm and boll weevil.

GEORGIA OPM PLAN

Cotton insect management is based on a knowledge of both potential and existing insect conditions in the field and requires the expertise to address these conditions. Current Insect Control in Georgia is very similar to the Optimum Pest Management described in detail herein; both CIC and OPM utilize scouting programs and grower education. The difference between programs is in the intensity of survey and educational efforts.

Cotton is grown in approximately 100 of Georgia's 159 counties; average field size is 30 acres. Cotton ranks 13 among the state's agricultural commodities. Acreage varies considerably from year-to-year depending on prices of alternative crops, primarily soybeans and corn. The state has experienced a gradual shift in cotton acreage from north to south during the last several years and an increase in planted acreage over the last three years.

Because of the recent increase in cotton acreage, estimates in this report are based on 190,000 acres. The geographical spread of this acreage and the limitation of one entomologist per 30,000 acres precludes close supervision and monitoring of diapause spray applications. For this reason, boll weevil trapping in all alternatives of OPM is confined to survey purposes and a trap density of one trap per 200 acres.

All scouting costs, including those for supervision, are paid by producers. County Extension personnel will continue to provide technical support to OPM programs at the county level, but no costs are budgeted for this support. Any additional costs incurred for county Extension staff involvement in OPM must be absorbed by regular funds as they currently are under CIC.

Finally, the current definition of OPM assumes no in-season sprays for boll weevil due to diapause and overwintered control. Given the level of participation expected in OPM-I, the success of such a program is questionable since the only diapause program conducted in south Georgia met with only limited success.

I. Pest Monitoring

A. Scouting

Routine scouting of cotton is the primary method of monitoring insect pest infestations. Scouts are also regularly used to collect leaf petiole for nitrate analysis, soil samples for both nematode and fertility aasays, and weed infestation data for weed mapping. The increasing interdisciplinary responsibilities performed by scouts insures their continued involvement in future cotton production systems, including all OPM alternatives.

Regular scouting (twice/week) begins in early June and continues through mid-September and is performed primarily by students. During the 13-week scouting season the insects monitored are boll

weevil, Heliothis spp., plant bug complex, spider mites, and the beneficial insect complex. Occasional pests such as beet armyworm, fall armyworm, loopers, whitefly and others are reported as they occur.

Most of Georgia's cotton acreage (94%) is scouted. The majority of this is done through Extension-sponsored county pest management associations and a portion is scouted by independent scouts employed directly by growers. In either case, scouts are trained by the Extension Service. A small percentage of acreage is under the supervision of private consultants. In an OPM program, scouting would be conducted as it presently is.

Field monitoring before and after scouts are available must be done by growers. Training in survey procedures is routinely provided by Georgia CES. Growers are taught to inspect seedling cotton for thrips and other occasional early-season pests and pre-squaring cotton for boll weevil. Late-season monitoring by growers is for Heliothis damage to bolls, boll weevil, and pests such as spider mites or cotton leafworm that could cause premature defoliation. These scouting functions would continue to be performed by growers under OPM since a source of labor for an extended scouting season has not yet been identified.

B. Boll weevil trapping

The use of pheromone baited traps for monitoring the emergence of overwintered boll weevls is a well established practice in Georgia as in other states. In addition, traps may be used to determine the late-season population entering hibernation. However, transportation costs required to check traps make this tool less reliable in future programs since growers must assume this responsibility. OPM project personnel determine overwinter survival and late-season populations on an area-wide basis.

C. Heliothis survey

Current Heliothis survey methods include sugar lines, pheromone baited traps and black light traps. Their use would be continued in OPM programs. An expanded black light trapping program is being initiated in 1980 under a fall armyworm monitoring program. Heliothis data will also be collected and would be available to OPM programs.

D. Computerized insect alert system

A system of remote computer terminals in county Extension offices is currently being developed in Georgia. Scouting reports will be entered daily via terminals and summarized by a central

computer. Insect population trends can be plotted and alerts issued accordingly.

II. Pest Management

A. System approach

A production system which minimizes pest pressure is the first step in managing cotton insect pests. Such a system is being developed and implemented in Georgia. Components of the production "package" that influence insect populations include nitrogen management, stand density, row spacing, date of planting, and nematicide application. The total package is designed to shorten the fruiting period and facilitate early harvest, thereby reducing the need for late season sprays.

B. Beneficial arthropods

Predators and parasites play a significant role in suppressing cotton insect pests, particularly Heliothis, from early squaring to peak bloom. Tobacco budworm infestations rarely reach economic levels in June if beneficial insect populations are conserved. However, July budworm flights often overwhelm natural controls and require chemical applications. OPM and the resultant reduction in boll weevil would allow for maximum utilization of beneficials in fields where tobacco budworm infestations were light to moderate.

A complicating factor relative to the utilization of beneficial arthropods is the increasing importance of the plant bug complex in a short season cotton production system. Tarnished plant bug, the primary member of the complex in Georgia, is routinely monitored by scouts and must be considered in all IPM alternatives. Indeed, a greater portion of Georgia's 1980 cotton acreage required treatment for plant bug than for boll weevil.

C. Thresholds

Action thresholds serve as a basis for insect control decisions. Those charged with judging the necessity for insecticide application must consider other factors such as crop phenology, weather and economics and then adjust thresholds accordingly.

Thresholds for boll weevil depend on growth stage. Prior to the existence of third-grown squares suitable for oviposition, infestations in excess of 250 to 300 boll weevils per acre warrant a pinhead square spray. However, since growers must make this determination and are often occupied with other necessary farming

consider a field's boll weevil history, severity of the winter and pheromone baited trap catches to determine the potential practices during this critical period, a simpler, but less accurate, method is often employed. Growers for boll weevil infestation. Then a check is made in high probability fields for the presence of "black flags," wilted leaves caused by boll weevil feeding on petioles.

From third-grown square to first bloom, the boll weevil threshold is at its highest because of potential early problems with Heliothis. During this period insecticide applications are withheld until boll weevil damaged square counts exceed 25 to 30 percent.

After cotton begins blooming, the F_1 generation begins. The threshold is reduced to 10 to 15 percent damaged squares for the remainder of the season. However scouts are instructed to watch for freshly emerged boll weevils in blooms since this is an effective method of timing sprays to avert inevitable fruit loss.

Heliothis thresholds are also dynamic but hinge on the date of the first insecticide application that eliminates beneficial insects. Prior to the first spray, counts of larvae must exceed 8 per 100 plant terminals to warrant treatment. After the first spray the threshold is reduced to 5 larvae per 100 plants.

Action thresholds for plant bugs, spider mites, whitefly, and other pests are employed by cotton producers.

D. Insecticides

1. Early-season: Preventive treatments are recommended and commonly used for control of thrips. applications of systemic insecticides at-planting insure early unrestricted growth and facilitate directed herbicide applications.

2. Mid and late-season: Applications of insecticides for control of tobacco budworm are made as needed. The first potentially damaging moth flight of the season occurs in June but is usually suppressed by beneficial insects. The second flight, also tobacco budworm, occurs in early to mid-July. This flight often triggers the first spray of the season. The common bollworm is the predominant species in August and both species are a threat in September. Growers have several chemicals from which to choose for Heliothis control. The pyrethroids are most commonly used against the budworm in July and standard formulations containing methyl parathion are applied in August for bollworm control.

Using OPM it is assumed that boll weevil will not require treatment until later generations in August. Should boll weevil exceed threshold levels, spray intervals will be shortened to 3-5 days until control is achieved. Standard formulations containing methyl parathion provide economical control of boll weevil and maintain control of the bollworm.

Other insecticides may be applied as needed for control of outbreaks of occasional pests.

E. Pinhead square sprays

Controling emerging overwintered boll weevils prevents loss of early fruit and reduces subsequent generations. Azinphosmethyl at 0.125 pounds a.i. per acre applied prior to the third-grown square

effective when they are made after the peak of overwintered boll weevil emergence. In south Georgia, cotton is often squaring profusely when emergence peaks, making chemical application risky. When beneficial insect populations are eliminated, the potential for economic problems from the June tobacco budworm flight increases.

F. Diapause control

Diapause control, although proven effective in some regions, has not been readily practiced in Georgia. Growers have been reluctant to invest money when their planting intentions for the coming season were uncertain and much of the land they farmed was rented a year at a time. Also, when cotton matures in early September and Heliothis is no longer an economic threat, regular insecticide applications are terminated. A diapause control program would require sprays from mid September through mid-November and would represent a considerable cost. Although diapause control would be an integral component of OPM, it is doubtful it would meet with much acceptance, even with incentives.

ALABAMA OPM PLAN

Situation

Cotton production in Alabama has rapidly shifted to larger production units and away from the Southeastern peanut producing and "Sand Mountain" counties. Acreage is now concentrated primarily in the Tennessee Valley counties and in several Central Alabama counties. Since 1974, acreage has declined rapidly from 585,000 to approximately 300,000 in 1979. The acreage decline during this later period is primarily in response to poor yields, high costs of production in relation to prices and more favorable cost-price ratios for alternative crops (primarily soybeans).

Average losses to cotton insects during the last five years are estimated at 18 million dollars annually. An additional 23.3 million dollars were spent on control measures.

Since the cost of controlling insects represents about 30% of the total variable cost of producing cotton, the use of cotton insect management practices should be expanded. Corrective action should be taken to encourage greater participation in scouting programs. Growers should adopt practices that promote early maturity, utilize recommended insect management practices including scouting beneficial insects and economic thresholds; and utilize competent private consultants to advise them on management and control decisions.

Extension trained growers are currently monitoring fields, either themselves or by employing scouts or private consultants on approximately 90% of the cotton acreage. Practically no acres are currently receiving pinhead square or diapause applications. Unless 100% of all acres in a geographical area are treated for diapausing boll weevils, the benefits derived from such a program will not be worthwhile. Few growers will choose to apply diapause applications at their own expense due to poor results obtained from previous diapause program efforts. Pinhead square applications, according to previous observations and experiences, are more effective than diapause applications. However, due to the precision with which pinhead square applications must be made the decision on timing in each individual field must be done by a professional person (private consultant or Extension entomologist).

Approximately 100% of Alabama's cotton acreage would need three or four diapause applications for boll weevils in an average year. Approximately 10 to 25% of the acreage would also benefit from a pinhead square application. The acreage requiring pinhead square applications would be in the central and sourthern parts of the state where overwintering boll weevil numbers are highest.

Optimum Pest Management Structure

Existing cotton pest management personnel are currently located as follows: project leader located at Auburn University; two area entomologists--one each in the two major cotton producing areas of the state; and four county

agents-pest management--one in the central Alabama cotton producing area and three in the Tennessee Valley production area. Additional support personnel in the fields of weed science, agronomy, plant pathology, agricultural engineering and economics are located at Auburn University.

Additional manpower needed for OPM are: three area entomologists, five technicians (B.S. level), weed scientist (1 MY), agronomist (1/4 MY), agricultural engineer (1/2 MY), and six scout supervisors.

All regular Extension educational methods will be used to reach Alabama cotton growers. Individual contacts, group contacts, newsletters, radio and television, and automatic answering toll-free telephones, and telephones and/or mobile units in automobiles of all program personnel will be used in making insect management and control recommendations.

1. Thresholds for Treatments

Treatment thresholds are used as a guide in making economic decisions on cotton insect control in Alabama. However each field and each year is different. Treatment decisions must also be based on factors other than insect numbers or insect damage. Factors such as crop phenology, weather and economics are just as important as the actual insect numbers.

Boll Weevils (In-Season). Controls prior to first bloom are seldom economical. After first bloom, make four applications at five-day intervals when damage exceeds 15%. Thereafter, treat when field surveys indicate a damaging infestation level. Under heavy infestation pressure, a spray interval of three to four days may be warranted.

Bollworms, Tobacco Budworms. In previously untreated fields, apply when ten small larvae per 100 terminals are found or when 10% of squares are damaged. In previously treated fields, apply when five small larvae per 100 terminals are found or when 5% of squares are damaged. During recent years adequate control of tobacco budworms has not been achieved in some areas of Alabama. Evidence indicates that this species is developing some degree of insecticidal resistance.

Biological agents, such Bacillus thruingiensis (Bactur, Dipel, Thuricide) and the NPV virus (Elcar), have been used in suppressing light to moderate early season bollworm infestations without destroying beneficial insects. These materials should only be used under a close scouting program. Timing of application is very important for best controls.

Fleahoppers, Plant Bugs. Make one or more applications when 100 adults and/or nymphs are found per 100 row feet. If pinhead square set is less than 75%, make one or more applications when populations exceed 50 adults and/or nymphs per 100 row feet.

Treatments for other insects such as cabbage loopers, aphids, cutworms, fall armyworms, spider mites, thrips and whiteflies are based more on a judgment of the level of damaged being done.

2. Use of Traps

OPM project personnel would establish representative sample weevil trapping locations to determine overwintering survival and time to peak emergence. This information would then be used to make pinhead square recommendations.

Additional black light traps will be strategically located and monitored throughout the growing season in order to detect population cycles and changes.

3. Scouting Practices

Growers are responsible for all in-season insect controls and are encouraged to follow Extension Service recommendations. Growers always have the final voice in making insect control decisions.

Growers either attend Extension scouting schools and scout their own fields or employ scouts or consultants to monitor for them. The entire cost of this phase of an OPM program would be funded by the growers. Approximately 95% of the acreage will be monitored under one of the above conditions. In an OPM program scouts will be trained by the Extension Service and will operate under the technical supervision of either the county agent, scout supervisor or an area entomologist.

Scouts begin work about June 15 and work until about September 10. However this is left up to the discretion of the employing growers. A significant number of acres are scouted twice per week. More acres should be monitored in this manner under an OPM program.

4. Conservation of Beneficial Arthropods

Predators and parasites play a significant role in suppressing cotton insect pests, particularly Heliothis, from early squaring to peak bloom. Tobacco budworm infestations rarely reach economic levels in June if beneficial insect populations are conserved. However, late July-early August bollworm moth flights often overwhelm natural controls and require chemical applications. OPM and the resultant reduction in boll weevil would allow for maximum utilization of beneficials in fields where bollworm and budworms infestations were light to moderate.

A complicating factor relative to the utilization of beneficial arthropods is the increasing importance of the plant bug complex. Tarnished plant bug populations are routinely monitored by scouts and must be considered in all IPM alternatives.

5. Selection, Timing and Application of Insecticides

Preventative treatments are commonly used for control of thrips. Pinhead square applications should be based upon the growers choice as to whether to apply or not. The suggested treatment level would be approximately 25 weevils per acre as determined by examining, in select fields, at least 250 row feed of seedling cotton per field or per 25 acres. Trap captures will be used to determine when the pinhead square aplication is needed. The insecticide used should be methyl parathion or Guthion. Dimilin® treated fields will be given special consideration but would still be considered for pinhead applications prior to the initiation or at the termination of the Dimilin® applications.

The first moth flight of the season occurs between June 10 and 25 and is primarily the tobacco budworm. Unless growers have mismanaged their production practices and reduced beneficial insects they will give adequate control of this generation of Heliothis.

Without pinhead square applications, boll weevils reach economic levels in south and central Alabama with the F_1 generation in early July. Under an OPM program approximately three to four applications might be eliminated before the second generation of boll weevils and bollworms occur and require controls in late July. In north Alabama boll weevils normally do not reach treatment levels until the F_2 generation in early August. An OPM program will have little effect on weevil-bollworm control on this 60% of the states acreage.

Diapause control, has not been readily practiced in Alabama in recent years after much disappointment in prior years. Growers have been reluctant to invest money when their planting intentions for the coming season were uncertain and much of the land they farmed was rented a year at a time. Also, when cotton matures in early September and Heliothis is no longer an economic threat, regular insecticide applications are terminated. A diapause control program would require sprays from mid-September through mid-November and would represent a considerable cost. Although diapause control would be an integral component of OPM, it is doubtful it would meet with much acceptance without incentives.

6. Cultural Practices

Extension agronomists, weed scientist, plant pathologists-nematologist and agricultural engineers would assist with all aspects of an OPM

aspects of an OPM program ranging from cultural practices (seedbed preparation) and weed control to pesticide applications, defoliation and harvesting. Educational information in this area is based on research findings and is in accordance to current Auburn University recommendations.

7. Program Evaluation

Data for program evaluation will be collected by the program personnel from a sample of the participants. An economist-pest management is currently a member of the Alabama Cotton Pest Management team and would be responsible for collecting the data with the assistance of the area entomologist, county agents-pest management, scout supervisors or technicians.

8. Advisory Committee

A statewide cotton pest management advisory committee which functioned between 1972 and 1975 will be reactivated. In addition, each county will have their own advisory committee made up of growers and other agrichemical and agribusiness related persons to offer guidance for the program at the county level.

TENNESSEE OPM PLAN

Educational Systems for OPM Implementation

At present, the University of Tennessee, Agricultural Extension Service has three area Assistant Agents in charge of field coordination of IPM in the cotton growing area. Their major responsibilitiesinvolve initiating county IPM programs and acting as liaisons between producers and other county staff. To date, 10 of the 15 cotton growing counties are actively participating in the IPM program. Future plans involve an expansion of territory covered by these area agents to all cotton counties.

In order to successfully carry out the additional work required under the OPM program, more persons in the capacity of field technicians and supervisors will be required. This is necessitated by a more intensified boll weevil monitoring system in field and by using pheromone traps.

Detection and Surveillance Systems

The first phase of insect pest surveillance will consist of using grandlure baited field traps in the spring (April 15 - June 15) and fall (September 15 - November 15). An initial density of one trap per 200 acres of cotton should be sufficient for the OPM portion of the project. spring trapping will serve as the basis for pinhead square applications and fall trapping will aid in planning and evaluation of a fall diapause program. A combination of technicians and county extension staffs will be utilized in trap placement and monitoring activities.

Black light traps will serve as monitoring devices for *Heliothis zea* in each county. The traps will be run twice weekly during a period from mid-June through mid-September. The number of traps will vary in each county depending on the cotton acreage. These traps are not a substitute for field scouting but serve to alert scouts and growers of major *Heliothis* moth flights. Virelure pheromone traps may be used in conjunction with the black light traps for *Heliothis virescens* monitoring if a reliable trap is available.

Most of our bollworm damage is the result of *Heliothis zea*. Reports from field crop entomologists and state survey entomologists will be utilized as a tool for detecting *H. zea* populations as they occur on adjacent hosts such as field corn.

Data Storage and Retrieval

The data from both insect pest detection systems will be coded for computer analysis each week. A rapid turnaround on field data will be utilized in assisting decisionmaking procedures.

Field Scouting Approach

The "scouting" of cotton for insects and their damage has been the mainstay of our insect pest management program. The scouting program will be expanded to meet the needs of the proposed OPM program. Currently, 12 - 15 percent of the acreage planted to cotton in our participating counties is "scouted" by extension trained and supervised scouts. Under the proposed OPM program, over 90 percent of the cotton should be monitored by trained scouts and/or commercial consultants.

The majority of the cotton will be checked weekly. Twice a week scouting will be recommended in areas of heavy bollworm pressure. Scouts will make notes concerning plant growth and square retention, weeds, diseases, and other factors concerning crop development, in addition to insect data. The scouts will use sampling techniques which are recommended by the University of Tennessee. Complete insect data will be collected and maintained on computer printouts for all the cotton in the program.

Management Decisionmaking

Producers will be urged to follow extension service recommendations for in-season pest control. The local extension staff or a member of the pest management specialist staff will make recommendations as to treatment levels, application rates, timing of applications, etc. The decision to recommend a pinhead square application will be made by the specialist staff based upon the numbers of weevils captured in the grandlure baited traps. Diapause control applications are not generally recommended in Tennessee. If diapause control becomes warranted, the specialist staff will make recommendations as are deemed necessary.

Conservation of Beneficial Arthropods

All cotton production practices will be geared toward conserving the beneficial arthropod complex as much as possible. Economic thresholds will be utilized to restrict use of insecticides on an as needed basis only. All unnecessary applications will be eliminated to encourage buildup of predators and parasites for effective biological control.

MISSOURI OPM PLAN

Program Area

Cotton production is limited to the seven most southern counties in Missouri. Of these seven, the three most southern; Dunklin, Pemiscot, and New Madrid comprise over 85% of the cotton acreage in the state with the remaining acreage located in Stoddard, Scott, Mississippi and Butler counties.

Crop Situation

There has been a steady decline in the cotton acreage since 1958. This reduction can be attributed to low yields, high cost of production with yield uncertainty, increased soybean production, weather related factors, etc. However, in the last five years the number of planted acres has remained fairly constant as production is restricted to that land most favorable for production, prices have been more favorable. The need for an alternate nonhost crop to combat the soybean cyst nematode has become necessary.

Insect Situation

Insect populations vary from year to year. In general damaging populations of insects are less than in order cotton growing areas of the Delta and beneficial insect populations are favorable throughout most of the year where insecticides do not destroy these insects.

A large amount of insecticide usage is directed towards thrips control. The use of in-furrow insecticides or directed sprays is common practice in controlling heavy migrating popullations from wheat and other host plants.

Plant bugs are more a result of improper management than any other factor.

Missouri producers have excessive plant populations in their fields along with high nitrogen levels which lead to a build-up of plant bugs. Often, damaging populations are allowed to build for fear that control measures would produce a bollworm outbreak resulting in costly control measures. However, plant bug damage often results in a much higher loss than if control measures were initiated and carried through until harvest.

The cotton bollworm, Heliothis zea, is the major Lepidopterous pest of cotton. Infestations of this insect pest are sporadic, often geographically restricted, and do not usually occur until late July or early August at which time migrating populations from corn infest cotton. Good control can be achieved if populations are detected early and control measures applied on a timely basis.

The cotton boll weevil has never been a consistent, or serious pest, but during some years localized damage does occur. Boll weevils do not overwinter well in

this area due to the scarcity of suitable hibernation sites and low temperatures. Injury results late in the season from migrating weevils and control measures can be justified when boll damage is evident, and when a large percentage of squares are being punctured.

Current Program

The University of Missouri Cotton Pest Management Program is directed by the Area Entomology Specialist, supervised by the Cotton Pest Management Field Coordinator and assisted by three para-professionals which are employed on a seasonal basis. together a total of fifteen districts are surveyed on a weekly basis through the use of index fields which represents approximately 3% of the cotton acreage. The use of pheromone traps and light traps are also employed. Over 1,900 producers are kept informed by the "Weekly Cotton Insect Newsletter". In addition the use of radio, newspaper, direct contact, and other media are used to keep area producers informed of insect infestation levels.

There are only four professional consultants operating in the area which means that no more than 10% of the cotton acreage is scouted on a weekly basis. Another 50 to 60 percent is self scouted or scouted by an aerial applicator, but no written records are maintained and scouting is often infrequent or incomplete.

Optimum Pest Management

Implementation of an optimum pest management program in Missouri can be carried out through a reevaluation of current efforts and an intensification of these efforts on a broader scale.

Of first importance is the definition of program units of approximately 30,000 acres and the staffing of the units by professional and support staff.

Secondly is the setting up of detection and surveillance techniques. The use of grandlure baited traps will be employed at the rate of one trap per 200 acres. Traps would be checked on a weekly basis in April and May and every ten days during the summer and fall until frost.

In addition to the grandlure baited trap, one zealure-virelure trap would be located in a cotton field for every 10,000 acres of cotton.

Furthermore, black light traps will be used to monitor Heliothis populations. A network of six traps is already in operation, and the addition of two or three more black light traps would fill in the gaps now being experienced by the light trap network. As in past years, private consultants, 4-H persons, and extension professionals will be used to monitor these traps in order to provide up-to-date information on moth populations.

Adjacent hosts will be monitored by trained para-professionals. Corn in Missouri is the primary host of Heliothis zea and cotton becomes of importance to this insect the second week in July.

The Bootheel is a very diversified agricultural community and any changes in environment or related cropping practices can change conditions related to cotton production or conditions on other crops.

Unit personnel will work closely with producers in their area through direct contact, use of demonstrations, newsletters, news articles, and radio to insure that the cotton acreage is scouted on a regular basis.

Extensive demonstrations will be planned in each unit to show the value of short season cotton types, optimum planting times, rates, fertility, weed control, irrigation, and defoliation. These demonstrations will be continued on a yearly basis with different cooperators and every effort will be made to relay the benefits of these production practices.

Insecticides will be applied on an as needed basis according to economic thresholds and extension recommendations with conservation of beneficial insects in mind.

The use of a pinhead or early season application of insecticide for boll weevil control is not anticipated, late season and diapause applications will be applied as needed.

Evaluation of the program will be by extension councils and a Cotton Pest Management Advisory Team.

ARKANSAS OPM PLAN

To carry out optimum pest management will require organizing the cotton farmers of the state into working groups. These groups will consist of 15 to 50 farmers with a maximum area geographically of about 100 square miles and 30 to 50 thousand acres of cotton. Preferred size will be about 50 square miles and 30 thousand acres. Following organizational efforts, the Extension staff will carry out educational efforts to accomplish success in the following.

I. Plan a scouting program

A. Pheromones

1. Install survey traps for boll weevil in each field at the time of cotton plant emergence.

2. Install bollworm and tobacco bugworm traps in late May.

B. Field scouting will monitor plant development and all insect levels including beneficials in each cotton field beginning the first week in June and continuing to the end of the season.

II. Include the following practices in the production of the cotton

A. Select resistant varieties for boll weevil, plant bugs, and bollworms. Varieties used should exhibit maturity dates that avoid the period requiring the most insecticidal protection.

B. Plant

1. Control planting rate stand density should be in range of 30,000 to 68,000 (38" to 40" row solid) plants per acre on lighter soils and 75,000 plants maximum on heavy soils. Plant the thinnest stand for the soil type.

2. Plant at the optimum time for uniform stands and fast developing plants, April 25 to May 15, when soil temperature is 68°F. at the 2-inch depth.

3. Fertilize by soil test for best balance in growth and fruiting, monitoring nitrate in plants.

4. Control weeds early with a minimum of herbicide properly timed to reduce stunting and delay of crop. Substitute cultivation for herbicides as possible to avoid root damage and to encourage fast cotton root and plant development.

5. Watch soil moisture closely and use timely irrigation, if available, avoiding late water applications following stress and avoiding over watering that will cut oxygen off with resultant fruiting delays.

6. Defoliate by boll maturity. Pick as early as possible and destroy stalks before frost where possible.

III. Use insecticides as needed

A. Plant bugs - control plant bugs with low dosages of effective insecticides to suppress levels below levels causing economic fruit loss. Treat one or more bugs per three row feet when fruiting drops below 75 percent set or when weekly squaring rate of increase is less than 1 1/2 fold weekly (first six weeks of fruiting). Cotton setting squares heavily tolerates higher plant bug populations than cotton fruiting less.

B. Boll weevils - Apply a recommended insecticide for over-wintered boll weevils when at detectable levels prior to F^1 emergence. Apply to trap crops or in spots in infested fields utilizing or luring where applicable.

Finish the season with conventional insecticides that control both boll weevils and bollworms in fields with action levels of 1 1/2 boll weevil punctures or bollworm damaged square per row foot.

C. Bollworms - Treat for bollworms and tobacco budworms prior to bloom only with recommended biological or ovicides that do not reduce beneficials. After bloom, treat for one to two damaged squares per row foot or 10,000 plus worms per acre. Use insecticides on bollworms that will control boll weevils where boll weevil infestations are present in detectable numbers.

D. Diapause - If boll weevils are present in fields in detectable numbers at the end of the in-season insect control program, apply phosphate insecticides in a diapause control program of one to three applications as needed based on scouting.

E. OPM PI&I - Producers would receive incentive payment for diapause weevil control. No pinhead square applications are anticipated.

LOUISIANA OPM PLAN

I. Detection and Surveillance

A. Grandlure Traps

Will be operated April 20 to June 20 and September 15 to November 1 to determine location of boll weevil hot spots and relative density of boll weevil populations.

B. Black Light Traps

Will be operated June 20 to September 15 to detect Heliothis spp. and other lepidopterous moth flights.

II. In-Season Insect Management

A. Insect Scouting

Will be done by commercial consultants. Spot checking and providing consultants with advice in problem fields will be provided by OPM personnel. Farmers without consultants will be trained to scout their own cotton.

B. Predator and Parasite Conservation

Educational activities to encourage preservation of predators and parasites of Heliothis spp. will be conducted. This means no "pinhead" square insecticide use or other foliar insecticide applications prior to July.

C. Insecticide Use

Educational activities will be conducted to provide farmers and consultants with information needed to make decisions on insecticide timing, selection, proper application and when to discontinue their use.

III. Post-Season Insect Management

A. Boll Weevil Diapause Control

A program to get farmers to apply four insecticide appliations at 10 day intervals to control diapausing boll weevils will be conducted. Assistance and supervision will be provided by OPM personnel and county agents.

B. Cotton Stalk Destruction

A concentrated effort to get all cotton stalks cut and destroyed will be conducted by OPM personnel and county agents.

MISSISSIPPI OPM PLAN

I. OPERATIONAL UNITS

The OPM unit concept to statewide optimum pest management appears to be the most operationally feasible method for Mississippi. Some factors in establishing units are: 1) The operational size of the Optimum Pest Management Trial (about 30,000 acres); 2) Intensity of pressure from boll weevils and other insect pests; 3) Total cotton acres by county area; 4) Existing Extension district boundaries; 5) Location and number of Extension area and state specialists now employed; 6) Employment and management of operational personnel.

All counties in the state engaged in cotton production will be included in an OPM unit. Most counties with cotton acreage exceeding 30,000 acres are designated as a unit. As a result of this, most Delta counties are individual units. Personnel requirements and operational materials are determined by total acreage and total land area. Personnel requirements vary in each OPM region in Mississippi, but in general include a unit pest management specialist, a secretary and unit technicians.

The unit pest management specialist will work closely with the district agent, county agent(s), and his associate agent(s). Back-up support will be provided by the area pest management specialist and state specialists in carrying out all phases of his unit program. He will develop a cooperative atmosphere in his unit with all personnel directly involved in conducting pest management activities so that optimum pest management can be effectively carried out. Clerical and unit technicians will be under his direct supervision. Unit technicians will be needed to collect data on selected fields and monitor fields after regular employed scouts have returned to school. They will also operate traps, compile data, assist in mapping and perform many other operational activities. Growers will employ the services of a scout through an existing or newly developed Extension pest management program or private agricultural consultant firm. Scouting services will be totally financed by the grower. Data for evaluation of the program will be obtained through personnel with the program and supportive agencies.

II. DETECTION AND SURVEILLANCE

A. Boll Weevil Monitoring

1. Grandlure Baited Traps

Grandlure baited traps will be assigned in each unit according to the total participating acreage. Traps will be placed at field edges at a ratio of 1 trap per 200 acres in most regions of

Mississippi. The total number of traps by unit will vary. The operational period will be from April 1 to July 15 and September 1 to frost. Boll weevil populations will be monitored with in-field traps from June 1 to August 30 in a limited number of index fields in each unit.

B. Bollworm Tobacco Budworm Monitoring

1. Zealure and Virelure Baited Traps

One pheromone trapping station (4 traps--2 zealure, 2 virelure) will be located in each compass direction by unit. Each trapping station will be situated on a predetermined grid point at the most distant cotton field in each compass direction. This will enable unit personnel to better monitor emerging generations, migration, and improve timing of insecticides and ovicides. Comparisons between seasons can be made with this approach.

2. Black Light Traps

At least one black light trap will be operated in each unit. Large districts may require more than one trap. Each trap will be located in the center of the highest cotton production area or the highest historically known bollworm-budworm problem area.

III. PLANTING DATES

Optimum planting period for Mississippi is from April 10 to May 10. The further north and the lighter the color of soils, growers can plant later in the optimum planting period. Growers will be urged to plant cotton according to the optimum planting period. This will enhance the efficacy of the pinhead square application (or plant bug-bollworm/budworm suppression application), if needed.

IV. SCOUTING

All program participants will have their cotton fields scouted at least once weekly, but twice weekly scouting will be encouraged. Scouting reports on each field in each OPM unit will be made available to the unit pest management specialist and other personnel with the Mississippi Cooperative Extension Service. Participants will continue using the scource of scouting of their choice. Private agricultural consultants will continue monitoring their present acreage without limitations on expansion of services. Data on fields scouted by private agricultural consultants will be made available to Extension personnel through a cooperative agreement with the State Extension service or the grower association. The chartered non-profit pest management societies which are now in operation will serve as the basic organizational structure for

Extension programs. All counties in each OPM unit without operational pest management programs will be expected to organize a non-profit chartered pest management society by county or be part of one unit pest management society.

Scouts in county pest management programs will continue to be trained by Extension service personnel. The statewide cotton scout training program will be intensified with more initial training workshops and followup in-field training sessions. Consultants and their scouts, growers, industry, Extension personnel, research staff, and other interested groups will be invited to attend any workshop. Video tapes, other audio-visuals, and equipment will be provided to unit personnel for seasonal update training.

Scouting data generated through unit programs will be computerized with print-outs revised as data is available. A practical approach to data handling will be taken. This may make the grid-coordinate system of field identification essential to all programs with evaluation of program data done on reproducible index fields designates.

V. INSECTICIDE CONTROL

A. Pinhead Square Applications

One pinhead square application, if needed, will be applied to infested acreage in each unit. Criteria used in determining the need for a pinhead square are: 1) positive ground trash samples in the spring and fall; 2) significant pheromone trap captures; 3) 25 weevils per acre determined by examining at least 250 row feed of squaring cotton per field (25 acres).

B. In-Season Control

Cotton producers will be encouraged to follow the Mississippi Cooperative Extension Service insecticide recommendations. The source of these recommendations will be the Cotton Insect Control Guide. The local county agent, unit pest management specialists, area pest management specialist or private agricultural consultant will be expected to make control recommendations.

C. Boll Weevil Diapause Control

Boll weevil populations vary across the state of Mississippi. The intensity of infestations will dictate the diapause control approach. The course of action to be followed is outlined below in three distinct boll weevil areas.

1. Southern Hill Area

During most seasons, boll weevil infestations are highest in this area of the state. To compensate for a slightly longer growing season with a later frost date, a maximum of six boll weevil diapause applications may be needed following cessation of in-season control. Growers will be expected to follow the recommended approach to diapause control.

2. Northern Hill Area

This area is subject to moderate boll weevil pressure. Since pressure is less than the southern hill area, few diapause applications will be needed for effective management. Up to four diapause applications may be needed.

3. Delta Area

Little or no boll weevil infestations occur in the Delta. However, the perimeter areas along the delta "foothills" and the Mississippi River are subject to weevil activity. In these areas and in isolated spots, boll weevils reach an economic damaging level during the season and will require diapause control. Up to four diapause applications will be applied, if needed, in these selected areas of the Delta.

VI. VOLUNTARY STALK DESTRUCTION AFTER HARVEST

Growers will be urged to destroy cotton stalks in their fields once harvest is completed. Diapause treatments will be terminated if harvest is completed before frost.

VII. CONSERVATION OF PREDATORS AND PARASITES

All OPM components will be implemented with conservation of beneficial arthropods in mind.

TEXAS OPM PLAN

Insect pest management strategies are divided into two major regions in Texas (Northern, Southern). There are several areas across the state where optimum pest management is being practiced; or where some management components are being utilized.

The High Plains regions of Texas is currently free of boll weevil infestation. As a result, very little insect control is practiced in this area with the exception of occasional outbreaks of cotton fleahopper and bollworm. Therefore, one should consider that the optimum pest management program is already in place and is being maintained in the High Plains of Texas.

Within the boll weevil infested areas of the state, optimum pest management strategies have been developed that consider weevil biology and habits, weather patterns and crop production requirements. In the Rolling Plains, as with the other cotton producing regions within the state, the boll weevil is the major pest that requires continual management on a yearly basis. Efforts are made to control the boll weevil by delayed uniform planting dates, cultural practices, variety selection, crop residue destruction, selected insecticide applications (early season and fall diapause) and other practices that minimize midseason insecticide applications that may destroy beneficial insects and ultimately result in a costly Heliothis outbreak. The entire management system in this area is geared to avoid treatment for the cotton bollworm/tobacco budworm.

In the southern cotton producing region of the state (Central Texas Blacklands, Central Texas River Bottom, Upper Gulf Coast, Coastal Bend and Winter Garden area and Lower Rio Grande Valley) optimum pest management strategies include early planting of short season determinate varieties, early season boll weevil control by insecticide application, use of microbial insecticides when necessary, avoidance of treating in season populations of bollworm/tobacco budworm, and early harvest and crop residue destruction.

A third smaller cotton producing area in the state is the Trans-Pecos, which is currently free of boll weevil infestation. The El Paso Valley is considered part of the Trans-Pecos and can be considered to be under an optimum pest management program encountering only occasional insect damage. The Pecos Valley of the Trans-Pecos is currently in the process of developing a total cotton production system (Econocot) that will lead to optimum pest management. The Econocot system utilizes: cotton planting dates for optimum crop establishment and yield, lower fertilizer and irrigation rates, intensive insect scouting, and applying insecticides based on economic thresholds. Conservation of beneficial insects is the chief regulating factor of the cotton bollworm/tobacco budworm in the Trans-Pecos area.

Optimum Pest Management Component Descriptions

The basis of the optimum pest management programs in Texas are primarily centered around cultural manipulation and conservation of beneficial insects. There are a variety of crop production practices that when employed in a comprehensive systematic plan can provide significant management impact on a number of cotton pests. (Table 1). Manipulation of crop production inputs, development of insect population monitoring techniques and the judicious use of biological and chemical pesticides that consider the maintenance of beneficial insect populations will form the basis of future optimum pest management programs in Texas. The current benefit and projected use of a number of these components are described in the following paragraphs.

Planting Date

Manipulation of planting dates can produce significant reduction of boll weevil populations in Texas. Because of the overwintering and spring emergence habits of the boll weevil in the Rolling Plains, delayed uniform planting of cotton can provide significant separation of squaring cotton from overwintered boll weevils. This planting strategy capitalizes on weevil suicidal emergence and reduces the likelihood of the establishment and increase of subsequent summer generations. The continued implementation of this strategy is anticipated in areas where probability of inclement harvest weather during the fall is low.

In the Blacklands, Upper Gulf Coast, Coastal Bend-Winter Garden area and Lower Valley early planting dates are desirable. Early establishment of crops and the utilization of short season varieties allow for rapid fruiting, crop maturity, harvest and crop residue destruction. This management strategy capitalizes on the suppressing effect of limiting host plant material to late generation weevil populations. Early post harvest crop residue destruction adversely affects overwintering weevil populations and subsequent summer weevil populations by reducing the available food supply of diapausing weevils.

High Desnity Planting

The use of high density plantings has been evaluated throughout the state of Texas. Cotton varieties that perform well in high density plantings are becoming available to producers. It is known that high plant densities hasten maturity often without sacrifice in lint quality or yield. The strategy therefore, offers the opportunity to maintain economic returns while reducing the time the crop is exposed to boll weevil and bollworm populations. The development of more suitable cotton varieties and harvesting equipment may allow high density planting to become even more valuable as an optimum pest management tool in the future.

Table 1. Optimum Pest Management Components

Existing Technology	Major Cotton Pests					
	Boll Weevil		Boll/Budworm		Fleahopper	
	Southern 1/	Northern 2/	Southern	Northern	Southern	Northern
Variable Planting Date	X	X				
High Density Plant Population	X	X	X	X		
Short Season Varieties	X	X	X	X		
Resistant Varieties	X	X	X	X	X	X
Fertility	X	X	X	X		
Irrigation			X	X		
Weed Management			X	X	X	X
Defoliation	X	X	X	X		
Harvest	X	X	X	X		
Stalk Destruction	X	X	X	X		
Pheromone Traps	X	X	X	X		
Light Traps			X	X		
Field Scouting	X	X	X	X	X	X
Insect Models	X	X	X	X	X	
Weather Monitoring	X	X	X	X	X	X
Economic Injury Threshold	X	X	X	X	X	X
Early Season Chemical Control	X	X			X	X
Beneficial Insects	X	X	X	X	X	X
Microbial Insecticides			X	X		
Chemical Insecticides	X	X	X	X	X	X
Mid Season Chemical Control	X	X	X	X	X	X
Diapause	X	X				

1/ Central Texas Blacklands, Central Texas River Bottom, Upper Gulf Coast, Coastal Bend, Winter Garden area and Lower Rio Grande Valley.

2/ Rolling Plains.

Short Season Varieties

Texas Agricultural Experiment Station researchers have been instrumental in the development of a number of short season cotton varieties that are important to pest management in Texas. These varieties have been widely adopted by producers throughout the state. Short season varieties fruit rapidly and mature without loss in yield and lint quality demanded by producers. Because of the rapid growth and maturity of short season cottons, crop yields are produced with a reduced exposure to cotton insects. Thus boll weevil and bollworm/tobacco budworm damage can be effectively reduced by utilizing short season cotton varieties. It is anticipated that short season varieties will play an ever increasing role in the Texas optimum pest management plan in the future. The development of cotton hybridization with even greater potential for agronomic and entomological characterization should provide additional benefits from this management component in the future. This strategy combined with optimum planting dates provides a powerful insect suppression tool to the farmer at no cost.

Resistant Varieties

Texas Agricultural Experiment Station and USDA plant breeders have developed a number of cotton varieties that display resistance to boll weevil, bollworm/budworm, and cotton fleahopper. The integration of resistance characters into a wide variety of cottons is a major objective of the plant breeding programs for the future. Several commercially available varieties such as CAMD-E, TAMCOT SP 37H and TAMCOT SP 21S, exhibit resistance to the boll weevil, fleahopper and the bollworm/budworm complex. An ever increasing number of multi-adversity resistant cotton varieties will be integral components of optimum pest management programs in Texas.

Crop Fertility

Fertilizer inputs in cotton production and the resulting nutritional status of plants have important relationships to pest insects. Excessive fertilization often results in lush vegetative growth that is attractive to boll weevil, bollworm/budworm and other insects. In several cotton producing areas of Texas major efforts have been directed at utilizing fertilizer rates that balance the nutritional requirements of the plant while limiting plant attractiveness to insects. Optimum pest management programs will continue to stress the monitoring of soil fertility and the standardization of fertilizer inputs in cotton production.

Irrigation

Approximately 39% of the state's cotton acreage is produced under irrigation. Approximately half of this acreage receives only supplemental irrigation. The use of irrigation water similar to fertilizer inputs greatly affects the attractiveness of cotton to damaging pests. With the predictive capability of

the MOTHZV-3 computer model, irrigation scheduling is designed to allow cotton to receive necessary water requirements without being in a state of lush attractive growth during periods of peak bollworm/budworm moth flight. Manipulation of irrigation allows for reduced field humidity which also increases the desiccation mortality of bollworm/budworm eggs and other pests. Irrigation schedules based on plant need and insect pest status will be developed and utilized in OPM programs.

Weed Management

Considerable information needs to be gained concerning the interactions of weed management to insect management. It is known that alternative hosts for boll weevil, bollworm/budworm and the cotton fleahopper are important in the population dynamics of these pests. Further research on weed management may provide additional opportunities to manage these and other cotton insect pests throughout the state.

Crop Defoliation

The use of crop defoliants and desiccants have been long recognized as a management tool for the boll weevil and bollworm/budworm complex. Defoliation is the first step in eliminating plant material for the feeding and reproduction of boll weevil and Heliothis spp. complex. The use of defoliation in some areas in Texas has significantly reduced the number of generations of damaging pests. It is expected that timely crop termination will continue to be an important optimum pest management tool in the future.

Harvest and Stalk Destruction

Crop harvest and stalk destruction activities are important in eliminating the food and oviposition sites of the boll weevil, bollworm/budworm, cotton fleahopper and other cotton pests. Efficient harvest and crop stalk destruction thus reduced the "in season" population growth of a number of cotton pests. These practices can also have an overall reduction effect in the population of pests on an areawide basis. Crop termination practices will continue to be important in the development of our optimum pest management program across the state of Texas.

Pheromone and Black Light Traps

The use of pheromone traps to monitor boll weevil and Heliothis spp. populations will continue to be an important tool for interpreting insect activity in the OPM program. Extensive use of boll weevil and bollworm/tobacco budworm traps have allowed more accurate predictions of insect movement and population densitity. Research in the future will perhaps allow us to predict need for treatment as we become more able to relate trap catches to field density of various insect pests. It is expected therefore, that pheromone traps will

continue to have a monitoring capability as well as possible pest population suppression emphasis in future optimum pest management programs. Black light traps will also be utilized for monitoring Heliothis spp. activity, and assist in utilizing scouting resources in the most efficient manner.

Field Scouting

The utilization of field scouts in our optimum pest management program will continue to be extremely important. Trained field scouts and scout supervisors are associated with all cotton pest management programs at the present time.

Data collection by field scouts that represents insect activity, crop phenology, soil moisture, status of weed and plant disease pests and other pertinent information for making pest management decisions will continue to be the foundation of all future cotton optimum pest management programs.

Insect Modeling

Texas Agricultural Experiment Station and USDA scientists have developed insect models that predict the occurrence and population dynamics of the boll weevil and bollworm/budworm complex. The utilization of information generated by these models has been helpful in making overall pest management decisions. The continued refinement of these models will improve their utility and expand their base of acceptance. It is expected that the utilization of insect models to predict needs for pest control will play an even greater role in the optimum pest management programs of the future.

Weather Monitoring

Use of weather data as an input into insect models and for decisionmaking in other cotton production activities is increasing. It is expected that as we become more able to interpret regional and local weather affects on insect populations and crop phenology inhanced monitoring will become a more important component of our optimum pest management program.

Economic Injury Thresholds

Economic injury thresholds have been established for the major pests of cotton in Texas. (Table 2). Continued work to refine economic thresholds and to provide flexibility of interpretation relative to cotton varieties and other production situations will be necessary for the optimum pest management program. Education programs that continue to relate the importance of treatment on an as needed basis according to identified economic thresholds will be emphasized in OPM programs.

Early Season Chemical Control

Early season chemical control of the boll weevil and cotton fleahopper is often an important component of optimum pest management programs. This strategy of pest management capitilizes on early season pest population suppression thus affecting subsequent pest generations while at the same time reducing the likelihood of in season beneficial insect destruction resulting in bollworm/budworm outbreaks. Very effective boll weevil and cotton fleahopper control has been obtained with this technique and continued research is expected to make it more effective in the future. Early season control is utilized throughout the boll weevil infested areas of Texas and is a sound management approach for the boll weevil. It is expected that continued use of early season chemical control, where warranted, will be a strong part of the Texas optimum pest management program.

Beneficial Insects

Considerably research needs to be completed concerning the population dynamics of beneficial insects, methods of beneficial insects population field augmentation, and management potential for pest species. It is recognized that some population suppression for boll weevil, Heliothis spp. and cotton fleahopper can be attributed to beneficial insect activity. Pest management programs are designed to consider and maintain endemic beneficial insect populations. Prevention of beneficial populations will continue to be an important management component in our statewide optimum pest management program.

Microbial Insecticides

The use of microbial insecticides for Heliothis spp. suppression is increasing in the pest management program in Texas. Improvement in understanding modes of action and application technology for bacterial and viral insecticides are increasing. Additional research to determine the most efficient utilization and microbial insecticides is being completed. It is expected this research and other applied experiences with "microbials" will undoubtedly increase their importance in future optimum pest management programs.

Chemical Insecticides

The judicious use of chemical insecticides is important to the current pest management program in Texas. Considerable information concerning the use of chemical insecticides has allowed pest population suppression, while preserving to the fullest degree, beneficial insect populations. It is hoped more pest specific insecticides will become available for optimum pest management programs in the future.

Mid-Season Chemical Control

The use of insecticides during the mid season stage of crop production is dictated by the use of economic injury thresholds and is important in pest

Table 2. Suggested treatment levels (economic threshold)

Pests	Economic Threshold - Treat When:
Key Pests	
Boll weevil (overwintered)	Weevils are found at the "matchhead" (1/8-inch diameter) square stage to prevent egg laying
Boll weevil (in season)*	15 to 25 percent of 1/3-grown squares show weevil punctures
Cotton fleahopper	25 to 50 fleahoppers (adults and nymphs) are seen per 100 terminals examined during the first 3 weeks of squaring
Bollworm and Tobacco budworm	(a) Prior to initial chemical application 15 to 25 percent of 1/2 grown or smaller squares are damaged, or after bolls are present when 8 to 10 percent of green squares are damaged (b) After initiation of insecticide applications Bollworm eggs and 4-5 young worms are found per 100 terminals examined, and 5 percent of the squares and bolls have been injured by small worms
Occasional Pests	
Cutworms	Stand is threatened
Cotton aphids	Young cotton is noticeably stressed
Plant bugs	Square damage and crop becomes excessive
Armyworms	Plant damage becomes excessive
Loopers	Plant damage becomes excessive
Spider mites	Leaf damage becomes excessive

population management. The increased use of cotton plant and insect models and scouting data will provide for biologically sound, efficient use of chemicals during the mid-season with the maximum preservation of beneficial insects. This strategy will continue to be utilized in the optimum pest management program in the future.

Diapause Control

The use of diapause control has provided boll weevil population suppression in many areas of Texas without disruption of beneficial insect population and subsequent bollworm outbreaks. Continued evaluation concerning the utility of diapause weevil management will allow the most efficient use of this pest management component. It is expected that diapause boll weevil control programs will play a significant role in limiting overwintering population particularly throughout the Rolling Plains and West Texas cotton producing areas. Research concerning the effective use of diapause control for Gulf Coast and South Texas boll weevil populations needs to be completed. Traditionally, State Department of Agriculture funds have provided partial support of organized diapause programs in Texas.

Regulatory Component

Federal and state regulations have been established governing cotton planting and crop destruction to suppress the pink bollworm. Some consideration to extend these regulations to include the boll weevil is recognized as a possible management component. Further study to determine the economic and biological benefit of this regulation adjustment would be necessary. Compatibility of managing both pests with uniform planting-plow up guidelines may not exist in all affected geographical areas.

Program Communication System

Communication systems that analyze and disseminate pest management crop production information are important in our statewide optimum pest management program. A computer based data system called BUGNET is partially established. Eight stand alone IBM 5110 computers are strategically located throughout the state to support optimum pest management programs. An additional 6 computers will be needed to supplement the existing system in the future. Expected advances in computer technology make the future description of this system difficult. Pest and crop prediction models, crop production budgets, weather data and many other information items can be routinely processed and made available to cotton producers through the BUGNET system.

Pest management program annual reports, county handbooks, newsletters, and radio and TV are important communication techniques that will continue to support the optimum pest management program.

OKLAHOMA OPM PLAN

Although cotton producers in Oklahoma may experience sporadic damaging infestations of normally minor pests, such as the fall armyworm, beet armyworm, leaf perforator, cabbage looper and others, pests around which our management programs are designed are the boll weevil, bollworm-budworm complex and the fleahopper.

Damaging populations of these pests are often held below economic thresholds by climatic and other factors which affect pest reproduction and plant development. This is especially true in the upland dryland areas of Oklahoma. Pest management using sound practices including cultural, biological, varietial, pesticides when applicable, and all available technology to help maximize yields and profits while being environmentally sound, is a concept that should and will be implemented in cotton producing areas of Oklahoma.

Detection and surveillance to keep producers in all areas informed concerning arthropod populations, economic thresholds, and other factors which affect crop developments is the foundation on which our current programs are designed and all optimum pest management programs will be developed.

Some of the strategies which will form the proposed cotton pest management program for Oklahoma are:

I. Detection and Scouting

The initial phase of insect detection will consist of pheromone baited weevil traps set throughout known overwintering areas.

These traps which will be placed in candidate locations in May will be monitored weekly until heavy square set in July and again from September through harvest or first frost.

Trap monitoring will be conducted by area Entomologists, Extension Directors and temporary trap monitors either high school or college students.

Trap data will be used to inform growers either to prepare for boll weevil control or to prevent unjustified pesticide applications which destroy beneficial insects and often promote heavy populations of budworms and bollworms.

These data will be used to initiate early season (pin-head square) boll weevil control programs if necessary and diapause control programs.

II. Field Scouting

Field scouting will begin immediately upon emergence of the cotyledon leaves by scouts trained specifically in pest management survey techniques,

arthropod identification and plant phenology by Oklahoma State University specialists in Entomology and Agronomy.

Although records will be kept on square retention and other factors affecting plant development, the major emphasis will be placed on pest detection and identification.

All field scouting data will be used to construct models which can be used in long range programs of prediction and control.

Field scouting methods are uniformly conducted throughout the season. Unless circumstances dictate otherwide, dryland fields are normally monitored once per week whole irrigated fields receive two checks.

Depending upon the phenological period of development either 100 terminals of small plants, 100 squares, or 100 complete lrage plants are inspected at random by walking either in a horseshoe or "X" route across a field or each twenty acre portion of the field.

PESTS AND THRESHOLDS

Thrips - Seldom do thrip populations build to the extent of economic damage and negative reporting is hoped for. However, occasionally when plant emergence coincides with small grain harvest, extremely heavy damage may result from migrating thrips.

When this condition exists, the grower is notified and control using the lowest effective rate of a recommended pesticide is initiated.

Cotton Fleahopper - The cotton fleahopper is usually the only specie of the plant bug complex considered a primary early season cotton pest in Oklahoma.

Scouting for this insect is accomplished by examining 100 plant terminals at random in the diagonal or horseshoe type scout pattern described earlier.

Fleahopper monitoring is begun at pinhead square stage of growth and continued through the third or fourth week of squaring which is considered the period of greatest potential fleahopper damage.

Although the economic threshold population is considered to be 30 to 40% terminal infestation by either adults or nymphs, the initiation of control programs are based not only on fleahopper counts but also on square damage and square retention.

Usually when threshold populations are observed and the fruiting rate drops below 1 1/2 times the previous weeks fruiting rate during the first four weeks, then control is considered justified.

Again and especially at this period, if control is necessary, low damages of effective pesticides are selected with the conservation of beneficial insects a primary goal.

Boll Weevil - In conjunction with pheromone trap data, one hundred plants are inspected at random by walking diagonally across each field or each twenty acre portion for the appearance of adult weevils.

In the typical overwintering areas determined by the ecology and pheromone traps results, 100 plants with "match head" size squares are examined for the presence of adult weevils. Emphasis is given to the more mature plants which may be found near the overwintering habitat.

Should a weevil or weevils be detected at this stage, either one or two applications of a phosphate type insecticide or Dimilin®, if competitive, will be applied to prevent egg laying.

Timing of these early season applications is extremely important.

Applications made too close to bloom or the normal period of first bollworm activity should be avoided due to the danger of beneficial insect destruction and increased budworm-bollworm damage.

Mid and late season boll weevil control is recommended when 25% of squares are punctured unless a coinciding bollworm infestation dictates earlier initiation.

Applications of pesticides, usually one of the phosphate types, are repeated at 3 to 5 day intervals until infestations drop below the economic threshold.

Two to four diapause applications of a phosphate insecticide beginning in September and ending with the addition of a phosphate material to either a dessicant or phosphate-type defoliant will be recommended if scouting observations or pheromone trap populations indicate a need.

Field cleanup as early as possible will be encouraged in areas where wind erosion is not a problem.

Bollworm Complex - The bollworm-tobacco budworm complex is potentially the most serious problem confronting cotton producers in Oklahoma.

The primary goal of any pest management program is to use every method and all technological information to avoid having to begin an expensive, often long bollworm control program.

If at all possible, climatic conditions plus naturally occurring predators and parasites will be used to suppress bollworm and budworm populations.

When field scouting determines that five small worms and eggs are found per 100 plants or when 10% of squares are infested in July or 5% infested in August then control measures are determined to be justified.

These thresholds, however, are arbitrary and should be weighed in relation to beneficial insect populations, and other factors affecting crop development.

If a few small worms and eggs are found early with no weevil pressure involved, then an ovicide with or without a biological control agent should be considered as a control measure plus protection of beneficial species.

If it is determined that a different larvacide should be applied then one of the synthetic pyrethroids, which have been very effective, may be suggested.

Miscellaneous Pests - If determined by scouting observations, minor pests such as fall armyworms, cabbage loopers, leaf perforators, beet armyworms, whiteflies, and others become economically destructive, then control measures as outlined in Oklahoma State University Cotton Insect Control Suggestions will be initiated.

Optimum Pest Management Plant

Existing optimum pest management programs will be altered and improved through implementation of proven practices developed through cooperative interdisciplinary efforts of Entomologists, Agronomists, Pathologists, Plant breeders, and other specialists.

We will expect pest management to become more optimum through research developments of cultural practices, fertility management, irrigation management, cultivar selection, plant density studies, disease control, growth regulators, weed control, and defoliation.

ATTACHMENT B

BELTWIDE BOLL WEEVIL ERADICATION PLAN

CONTENTS

Prepared by

Plant Protection and Quarantine, APHIS, USDA

January 1981

Beltwide Boll Weevil Eradication

I. Introduction

This is a plan for eradication of the boll weevil from infested areas of the United States and measures to prevent reinfestation from outside sources. The procedures and cost estimates are based upon the technological and operational experience gained in the Boll Weevil Eradication Trial conducted in North Carolina and Virginia in 1978-80.

This plan was prepared primarily for the purpose of developing manpower requirements and cost estimates to be used in the evaluation of beltwide boll weevil/cotton insect management programs. Since the plan is primarily for the evaluation teams, costs are computed by the Delphi regions as designated by the evaluation groups. If a Beltwide Boll Weevil Eradication Program were implemented, the final plan would include input from all concerned agencies and groups. Costs presented herein, are based upon the 1979 costs in the BWET as agreed upon with the evaluation group. Cotton acreage is based upon 1974-78 averages. The estimated costs are for program requirements at the field level and do not include overhead or other assessments against these funds.

It should be pointed out that this plan was developed under the assumption that the role of the Extension Services would be essentially in a CIC mode with information and education support similar to that provided in the Trial. If the Extension Services were involved in an OPM mode and could achieve the results projected in the Delphi estimates, costs of boll weevil eradication could be lower than these estimates. The lower costs could result primarily from a need for fewer diapause treatments where fall populations are very low. However, it is expected that the greatest benefits to be derived from an OPM-BWE program would be the reduced pesticide use and yield increases with a more efficient management of Heliothis and other pests made possible by the absence of the boll weevil in the cotton pest complex.

II. Program Organization

The boll weevil infested area of the Cotton Belt and distribution of the 1978 cotton acreage within the area are given in fig. 1. Each zone is further divided into the Delphi regions used in development of operational cost estimates. The cotton acreage has been delineated into zones which are operational work units. The zones are numbered 1 through 8 with zone 1 in the Northeast extremity of the Belt and adjacent to the BWET area. Zone 8 is in the extreme Southwest along the US-Mexican Border. Within each zone and in fig. 2 the Delphi regions have been identified. Operational costs are computed for each Delphi region.

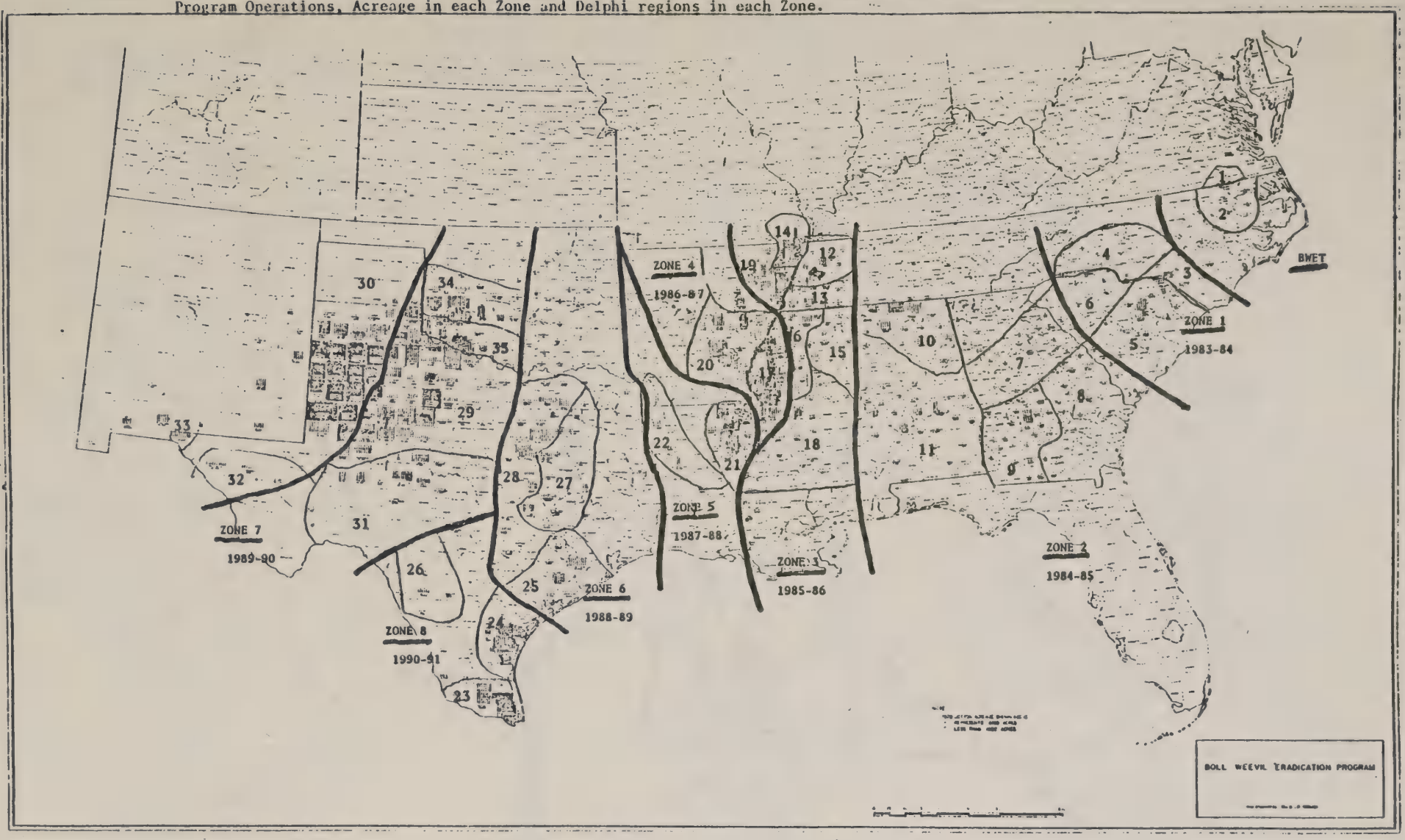
The zone boundaries were drawn through areas of lowest cotton density where such areas existed and allowed for a work unit of workable size. Zone 1 is the smallest in size purposely, to allow for buildup and training of personnel the first year. Zones 3, 4 and 5 offered little in the way of natural breaks and the area is too large to handle as one work unit. Accordingly, zones 3 and 5 on the East and West of the Mississippi flood plain, respectively, are smaller in cotton acres but larger in geographic area than the 1-million plus acres in zone 4. There is an excellent break in cotton between zones 5 and 6 through East Texas. Zones with open terrain and concentration of cotton have the greatest acreage but should present less operational problems than zones with less cotton, rough terrain and very scattered fields of smaller size.

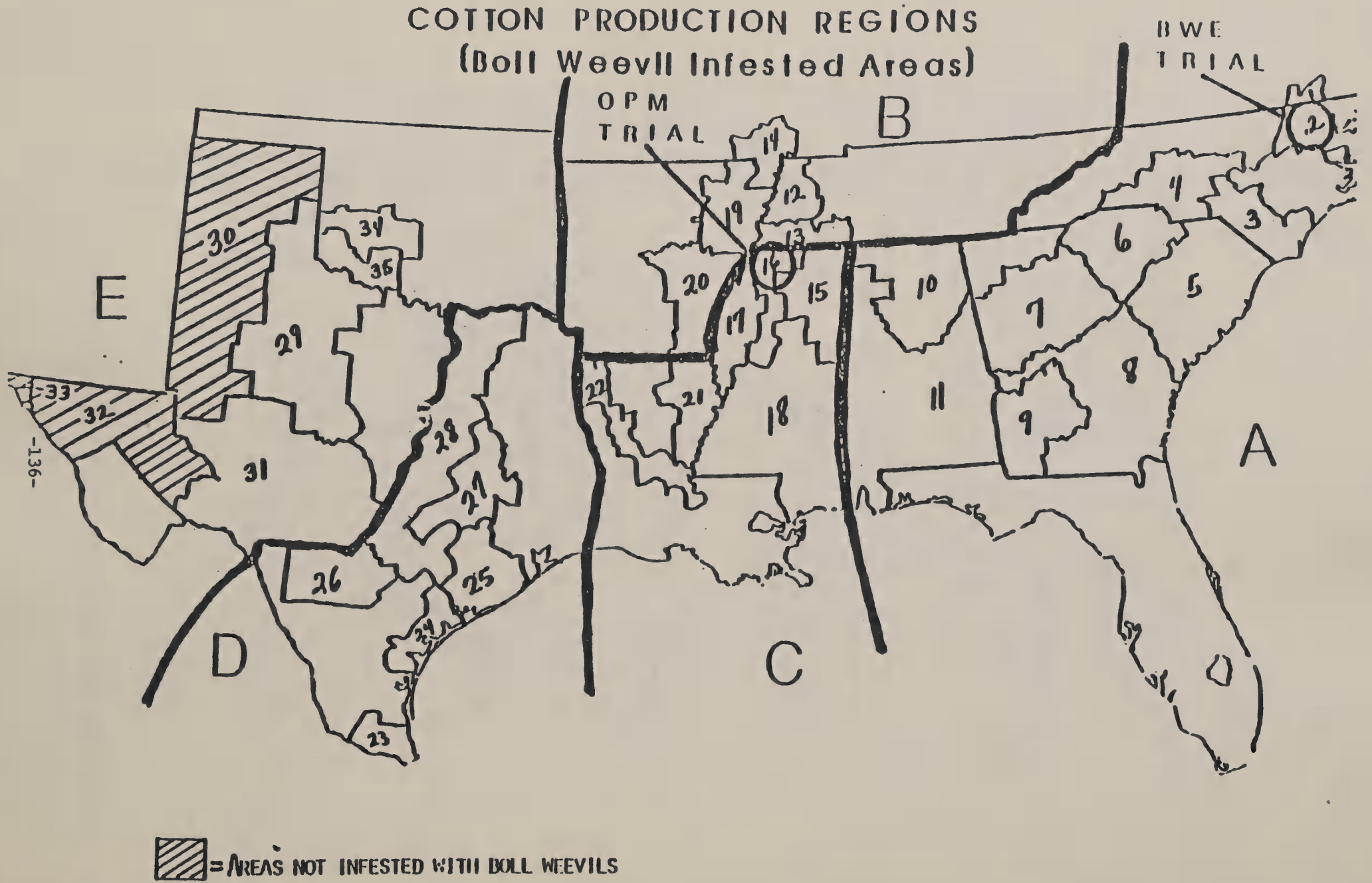
The operational plan is to initiate operations in zone 1 in 1983 and complete the program within the zone in 1984. Thus, the operations period in a given area is 2 years. In 1984, operations would begin in zone 2 and be completed in 1985. The operations group in zone 1, upon completion in 1984, would move on to zone 3 for a 1985-86 operational period. This use of two operational groups and a 2-year period in each zone allows for initiation of the program in successive zones each year and completion of the program in zone 8 in 1991.

A general table of organization is given in fig. 3. A major feature of this chart is the provision for two operational teams (A & B) since, except for the first and last years of the program, operations will be underway in two zones, simultaneously, in each year. It is expected that most of the manpower would be hired locally in cooperation with cooperating agencies and groups. Traditionally, the State Departments of Agriculture have been the major cooperators in these types of programs. It is considered necessary that levels of management above District Director, be USDA employees, to facilitate coordination, planning and execution across state boundaries. However, from District Director down in the chart, employees could be on state or USDA rolls. The number of District Directors, Area Leaders and temporary labor required are based upon cotton acreage, and the expected severity of technology application. Personnel would be assigned fewer acres in rough terrain, small fields and scattered plantings.

It should be pointed out that under this proposed program, operations personnel would survey only for boll weevil, primarily with pheromone traps. We would not do surveys for Heliothis, as was done in the BWET. This activity would be the responsibility of the growers and the Extension Services would assume responsibility for the continuing pest management program for other cotton pests.

Fig. 1. Cotton distribution in the boll weevil infested area of the Cotton Belt divided into Zones of Program Operations, Acreage in each Zone and Delphi regions in each Zone.




COTTON PRODUCTION REGIONS
(Boll Weevil Infested Areas)
OPM TRIAL
BWE TRIAL
A
B
C
D
E
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
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27
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29
30
31
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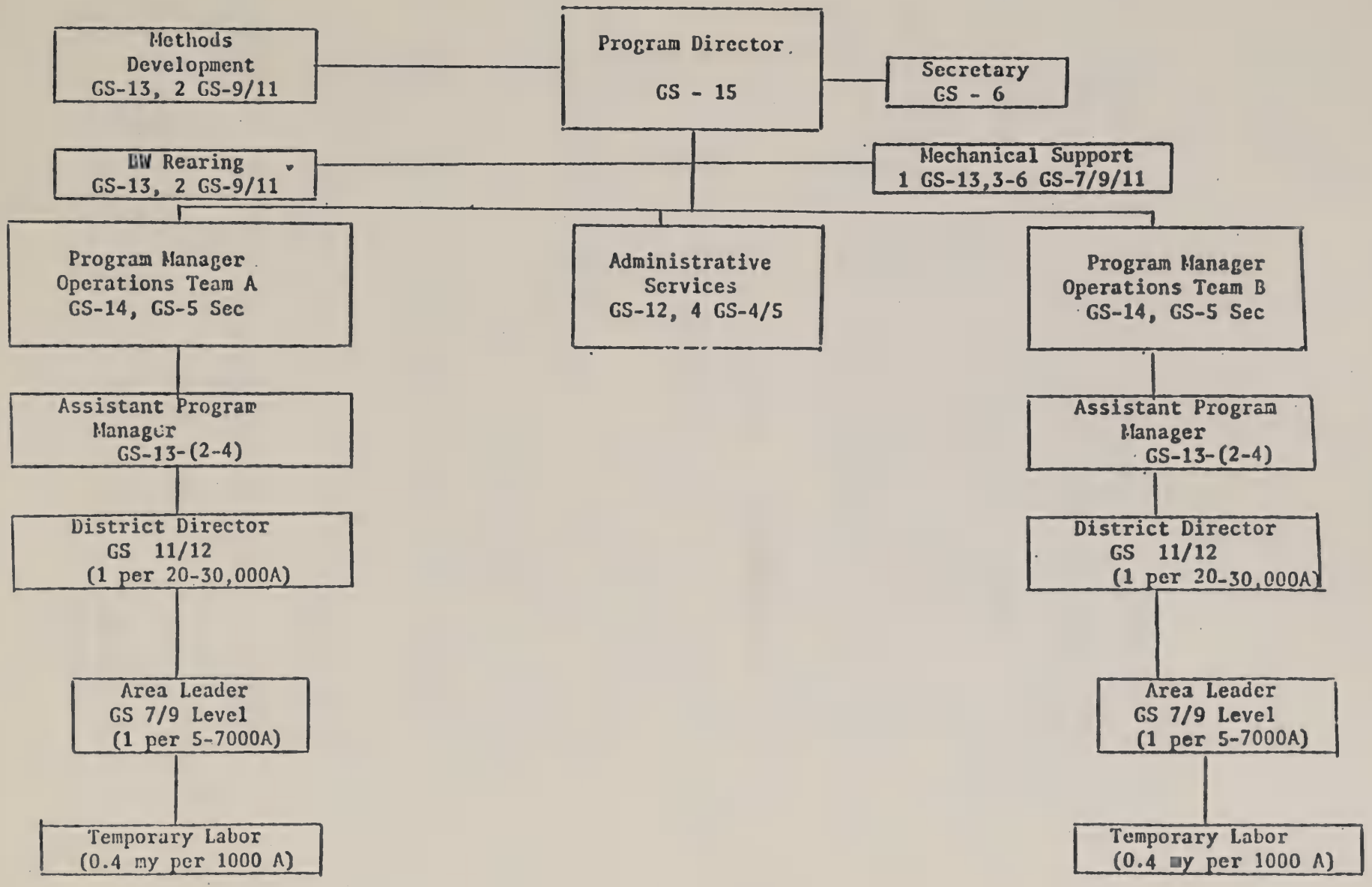
34
35
36
=AREAS NOT INFESTED WITH BOLL WEEVILS

Figure 2

Fig. 3

Organizational Chart - Boll Weevil Eradication



III. Operational Plan - Based upon a diapause control program with organophosphorus insecticides as the major boll weevil suppression method.

With this plan program operations would begin in each zone on July 1 and end June 30, 2 years later. Since the first population suppression measure is diapause control in the fall, it would not be necessary for personnel to be present during the earlier part of the growing season. The program will follow this sequence of activities:

1. The Extension Services in the states involved will have done an information and education program so that growers know about program requirements and activities prior to program initiation. They would urge growers to do a volunteer diapause program the previous fall. Also, we would depend upon the Extension Services for available data on severity of the boll weevil problem in the various areas of the zone.

2. Program personnel will be located in the zone in July.

3. Cotton fields in the zone will be mapped in cooperation with ASCS and state agencies in July and early August.

4. Fall survey traps at 1 per 10 acres (at least 1 per field) will be serviced from August to November in order to identify the severity of the boll weevil problem and to locate possible trouble spots.

5. Diapause treatments on all cotton acreage will begin in September after the regular season control program is completed by the grower, or before, if boll weevil populations are considered excessive. The initiation of diapause control will vary by zone because of the difference in the cotton production period. Insofar as possible, diapause control will be done during the harvest period. Treatment intervals will be 7-14 days, depending upon time of the year.

6. In zones where cotton harvest is normally completed before cotton plants are killed by cold weather, plant destruction by the grower will be required.

7. Diapause control will terminate when cotton plants are destroyed, either by cold weather or by the growers.

8. Spring traps at the rate of approximately 1 per acre will be placed around cotton fields of the previous season, oriented to potential hibernation sites. These traps will be serviced from 1 month before planting time until cotton begins to flower. This will be a period of about 3 months, during which new cotton fields of the current year will be mapped.

9. Where spring trap catches indicate a hazard of boll weevil population development in current cotton plantings, a series of 4 Dimilin® treatments at weekly intervals followed by a Guthion cleanup treatment will be made. These treatments will begin before fruiting begins and will be done on an "as needed" basis. The Guthion cleanup treatment will be timed, insofar as possible, to not contribute to a potential Heliothis problem.

10. Sterile boll weevils will be dropped on all cotton at the rate of 100 per acre per week for 4 weeks beginning at about the 6-8 leaf stage of cotton growth.

11. After completion of the sterile insect drop, inseason pheromone traps at the rate of 1 per acre will be placed in the cotton fields. This trapping activity will continue until cotton begins to mature.

12. Traps will be removed from fields as cotton begins to mature and placed around field borders and serviced until November (approximately 3 months) for the fall survey.

13. If fall survey results indicate the presence of a potential overwintering population, diapause treatments will be made on an "as needed" basis.

14. In the following spring, the spring survey around previous year cotton fields will be done through June 30.

15. On July 1, the survey operation will be turned over to the monitoring group and personnel will move to the next zone scheduled for operations.

16. In the event spot infestations of boll weevil persist or are found later, a special group will be formed to eliminate these populations. This group would be funded from the contingency portion of the operational budget.

This sequence of activities entails program action which covers 24 months. The period extends over one complete growing season plus parts of the previous (Fall) and part of the subsequent (Spring) seasons.

A summary of cost estimates for the plan described above by zone and by year, is given in Table 1. A detailed cost estimate by zone is given in Table 2.

Table 1 . Summary of acreage and costs by Delphi Region.

Delphi Region	Infested Acres	Operational Cost x 1000	Cost Per Acre		
			1st Yr	2nd Yr	Total
1. VA	0				
2. NC,North	0				
3. NC,South	43,337	3,302	45.11	31.08	76.19
4. NC,Piedmont	10,313	744	41.02	31.13	72.14
5. SC,Costal	156,474	11,902	45.06	31.01	76.06
6. SC,Piedmont	19,303	1,484	45.49	31.39	76.88
7. GA,Piedmont	35,446	2,620	43.53	30.38	73.92
8. GA,East	92,612	7,063	45.99	30.28	76.26
9. GA,Southwest	111,104	8,779	48.88	30.13	79.02
10. AL,Limestone	264,419	17,757	38.16	29.00	67.16
11. AL,South	173,889	14,000	50.12	30.39	80.51
12. TN,N. Brown Loam	137,986	9,676	41.21	28.91	70.12
13. TN,S. Brown Loam	89,899	6,840	45.79	30.30	76.09
14. MO,Bootheel	0				
15. MS,Northeast	94,705	7,268	46.57	30.18	76.74
16. MS,Northcentral	201,460	15,410	46.44	30.05	76.49
17. MS,Delta	895,960	53,987	32.84	27.42	60.26
18. MS,South	208,592	16,214	47.76	29.97	77.73
19. AR,Northeast	458,354	29,702	36.68	28.12	64.80
20. AR,Southeast	472,220	34,379	43.75	29.05	72.80
21. LA,Northeast	434,690	34,891	49.99	30.27	80.27
22. LA,Red River	77,565	6,292	50.41	30.71	81.12
23. TX,Rio Grande	278,820	23,812	55.26	30.14	85.40
24. TX,Lower Bend	118,849	8,506	42.29	29.28	71.57
25. TX,Upper Bend	89,639	6,410	42.29	29.22	71.51
26. TX,Winter Garden	20,416	1,751	55.40	30.37	85.77
27. TX,Central River	47,801	3,985	54.31	29.06	83.37
28. TX,Blackland	484,460	32,779	38.74	28.92	67.66
29. TX,Rolling Plain	946,081	60,333	36.12	27.66	63.77
30. TX,High Plains	0				
31. TX,Upper Concho	132,168	9,918	45.74	29.30	75.04
32. TX,Pecos	0				
33. TX,El Paso	0				
34. OK,North	0				
35. OK,South	158,477	10,286	36.72	28.19	64.91
TOTAL	6,255,039	440,090			

Table 2. A detailed cost estimate for program operations by Delphi region (35 pages).

Operational Costs by Region

Delphi Region - 1 - Virginia

Acres of Cotton (1974-78 average) Eradicated

	Cost x 1000
1. Personnel, Including benefits	
(a) Fulltime	
1. USDA _____MY -	
2. STATE/USDA _____MY - - - - - - - - - - - - - - - - - - -	
(b) Temporary (State) _____MY - - - - - - - - - - - - - - -	
2. Sterile Weevils	
(a) Rearing @2.20/1000 -	
(b) Dispersal @2.20/A -	
3. Chemicals - Diapause Control beginning 1st week in Sept. 1st year (Guthion or Malathion)	
(a) Number of treatments: _____@ /A - - - - - - - - - -	
(b) Application _____treatments @ /A - - - - - - - - - -	
(c) Dimilin followup as needed for remainder of program, estimated at 25% of acreage-cost per acre, 4 treatments including Dimilin, Oil and Application _____ - - - - - - - -	
(d) Cleanup treatment following Dimilin, Guthion and application - _____ - - - - - - - - - - - - - - - - -	
4. Traps -	
(a) Survey and infield-average of 1 trap/A-trap 83¢, service 16 times @16½¢ ea (3.47/A)- - - - - - - - - - - - - - - - -	
5. Measure Cotton @1.00/A -	
6. Vehicle Operation _____ -	
7. Misc.(phone, rent, travel, training, move personnel,etc.) 2.09/A- -	
8. Regulatory 1.10/A -	
9. Total Cost Per Year -	
10. Cost Per Acre -	
11. Total Region Cost -	
12. Total Region Cost Per Acre - - - - - - - - - - - - - - - - - - -	

Operational Costs by Region

Delphi Region - 2 - North Carolina, North

Acres of Cotton (1974-78 average) Eradicated

	Cost x 1000
1. Personnel, Including benefits	
(a) Fulltime	
1. USDA _____MY -	
2. STATE/USDA _____MY - - - - - - - - - - - - - - - - - -	
(b) Temporary (State) _____MY - - - - - - - - - - - - - - - -	
2. Sterile Weevils	
(a) Rearing @2.20/1000 -	
(b) Dispersal @2.20/A -	
3. Chemicals - Diapause Control beginning 1st week in Sept. 1st year (Guthion or Malathion)	
(a) Number of treatments: _____@ /A - - - - - - - - - -	
(b) Application _____treatments @ /A - - - - - - - - - -	
(c) Dimilin followup as needed for remainder of program, estimated at 25% of acreage-cost per acre, 4 treatments including Dimilin, Oil and Application _____ - - - - - - - -	
(d) Cleanup treatment following Dimilin, Guthion and application - _____ - - - - - - - - - - - - - - - - -	
4. Traps -	
(a) Survey and infield-average of 1 trap/A-trap 83¢, service 16 times @16½¢ ea (3.47/A)- - - - - - - - - - - - - - - - -	
5. Measure Cotton @1.00/A -	
6. Vehicle Operation _____ - - - - - - - - - - - - - - - - - - -	
7. Misc.(phone, rent, travel, training, move personnel,etc.) 2.09/A- -	
8. Regulatory 1.10/A -	
9. Total Cost Per Year -	
10. Cost Per Acre -	
11. Total Region Cost -	
12. Total Region Cost Per Acre - - - - - - - - - - - - - - - - - - -	

Operational Costs by Region

Delphi Region - 3 - North Carolina, South

Acres of Cotton (1974-78 average) 43,337

	Cost x 1000	
	1983-84	1984-85
1. Personnel, Including benefits		
(a) Fulltime		
1. USDA 3.9 MY	102	63
2. STATE/USDA 11.0 MY	223	223
(b) Temporary (State) 17.6 MY	153	153
2. Sterile Weevils		
(a) Rearing @2.20/1000	0	38
(b) Dispersal @2.20/A	0	95
3. Chemicals - Diapause Control beginning 1st week in Sept. 1st year (Guthion or Malathion)		
(a) Number of treatments: 7 @ 1.82 /A	552	0
(b) Application 7 treatments @1.60 /A	485	0
(c) Dimilin followup as needed for remainder of program, estimated at 25% of acreage-cost per acre, 4 treatments including Dimilin, Oil and Application 27.23	0	295
(d) Cleanup treatment following Dimilin, Guthion and application - 3.69	0	40
4. Traps -		
(a) Survey and infield-average of 1 trap/A-trap 83¢, service 16 times @16⅔¢ ea (3.47/A)	150	150
5. Measure Cotton @1.00/A	43	43
6. Vehicle Operation 2.50/A	108	108
7. Misc.(phone, rent, travel, training, move personnel,etc.) 2.09/A	91	91
8. Regulatory 1.10/A	48	48
9. Total Cost Per Year	1,955	1,547
10. Cost Per Acre	$45.11	$31.08
11. Total Region Cost	3,302,000	
12. Total Region Cost Per Acre	$76.19	

Operational Costs by Region

Delphi Region - 4 - North Carolina, Piedmont

Acres of Cotton (1974-78 average) 10,313

	Cost x 1000	
	1983-84	1984-85
1. Personnel, Including benefits		
(a) Fulltime		
1. USDA 0.9 MY	24	15
2. STATE/USDA 2.5 MY	51	51
(b) Temporary (State) 4.4 MY	56	56
2. Sterile Weevils		
(a) Rearing @2.20/1000	0	9
(b) Dispersal @2.20/A	0	23
3. Chemicals - Diapause Control beginning 1st week in Sept. 1st year (Guthion or Malathion)		
(a) Number of treatments: 6 @ 1.83 /A	115	0
(b) Application 6 treatments @ 1.49 /A	92	0
(c) Dimilin followup as needed for remainder of program, estimated at 25% of acreage-cost per acre, 4 treatments including Dimilin, Oil and Application 27.15	0	70
(d) Cleanup treatment following Dimilin, Guthion and application - 3.88	0	10
4. Traps - (a) Survey and infield-average of 1 trap/A-trap 83¢, service 16 times @16½¢ ea (3.47/A)	36	36
5. Measure Cotton @1.00/A	10	10
6. Vehicle Operation 2.75/A	28	28
7. Misc.(phone, rent, travel, training, move personnel,etc.) 2.09/A	22	22
8. Regulatory 1.10/A	11	11
9. Total Cost Per Year	423	321
10. Cost Per Acre	$41.02	$31.13
11. Total Region Cost	744,000	
12. Total Region Cost Per Acre	$72.14	

Operational Costs by Region

Delphi Region - 5 - South Carolina, Costal Plain

Acres of Cotton (1974-78 average) 156,474

	Cost x 1000	
	1983-84	1984-8
1. Personnel, Including benefits		
(a) Fulltime		
1. USDA 14.4 MY	369	229
2. STATE/USDA 39.0 MY	798	798
(b) Temporary (State) 62.6 MY	551	551
2. Sterile Weevils		
(a) Rearing @2.20/1000	0	138
(b) Dispersal @2.20/A	0	344
3. Chemicals - Diapause Control. beginning 1st week in Sept. 1st year (Guthion or Malathion)		
(a) Number of treatments: 7 @ 1.82 /A	1,993	0
(b) Application 7 treatments @ 1.60 /A	1,753	0
(c) Dimilin followup as needed for remainder of program, estimated at 25% of acreage-cost per acre, 4 treatments including Dimilin, Oil and Application 27.14	0	1,062
(d) Cleanup treatment following Dimilin, Guthion and application - 3.68	0	144
4. Traps - (a) Survey and infield-average of 1 trap/A-trap 83¢, service 16 times @16⅔¢ ea (3.47/A)	543	543
5. Measure Cotton @1.00/A	156	156
6. Vehicle Operation 2.48/A	388	388
7. Misc.(phone, rent, travel, training, move personnel,etc.) 2.09/A	327	327
8. Regulatory 1.10/A	172	172
9. Total Cost Per Year	7,050	4,852
10. Cost Per Acre	$45.06	$31.01
11. Total Region Cost	11,902,000	
12. Total Region Cost Per Acre	$76.06	

Operational Costs by Region

Delphi Region - 6 - South Carolina, Piedmont

Acres of Cotton (1974-78 average) 19,303

	Cost x 1000	
	1983-84	1984-85
1. Personnel, Including benefits		
(a) Fulltime		
1. USDA 1.8 MY	46	29
2. STATE/USDA 5.0 MY	102	102
(b) Temporary (State) 7.7 MY	68	68
2. Sterile Weevils		
(a) Rearing @2.20/1000	0	17
(b) Dispersal @2.20/A	0	42
3. Chemicals - Diapause Control beginning 1st week in Sept. 1st year (Guthion or Malathion)		
(a) Number of treatments: 7 @ 1.82/A	246	0
(b) Application 7 treatments @ 1.60/A	216	0
(c) Dimilin followup as needed for remainder of program, estimated at 25% of acreage-cost per acre, 4 treatments including Dimilin, Oil and Application 27.35	0	132
(d) Cleanup treatment following Dimilin, Guthion and application - 3.32	0	16
4. Traps -		
(a) Survey and infield-average of 1 trap/A-trap 83¢, service 16 times @16½¢ ea (3.47/A)	67	67
5. Measure Cotton @1.00/A	19	19
6. Vehicle Operation 2.75/A	53	53
7. Misc.(phone, rent, travel, training, move personnel,etc.) 2.09/A	40	40
8. Regulatory 1.10/A	21	21
9. Total Cost Per Year	878	606
10. Cost Per Acre	$45.49	$31.39
11. Total Region Cost	1,484,000	
12. Total Region Cost Per Acre	$76.88	

Operational Costs by Region

Delphi Region - 7 - Georgia, Piedmont

Acres of Cotton (1974-78 average) 35,446

	Cost x 1000	
	1984-85	1985-86
1. Personnel, Including benefits		
(a) Fulltime		
1. USDA 0.8 MY	21	21
2. STATE/USDA 9.0 MY	186	186
(b) Temporary (State) 14.2 MY	124	124
2. Sterile Weevils		
(a) Rearing @2.20/1000	0	31
(b) Dispersal @2.20/A	0	78
3. Chemicals - Diapause Control beginning 1st week in Sept. 1st year (Guthion or Malathion)		
(a) Number of treatments: 7 @ 1.81 /A	449	0
(b) Application 7 treatments @1.53 /A	395	0
(c) Dimilin followup as needed for remainder of program, estimated at 25% of acreage-cost per acre, 4 treatments including Dimilin, Oil and Application 26.74	0	237
(d) Cleanup treatment following Dimilin, Guthion and application - 3.61/A	0	32
4. Traps -		
(a) Survey and infield-average of 1 trap/A-trap 83¢, service 16 times @16½¢ ea (3.47/A)	123	123
5. Measure Cotton @1.00/A	35	35
6. Vehicle Operation 2.75/A	97	97
7. Misc.(phone, rent, travel, training, move personnel,etc.) 2.09/A	74	74
8. Regulatory 1.10/A	39	39
9. Total Cost Per Year	1,543	1,077
10. Cost Per Acre	$43.53	$30.38
11. Total Region Cost	2,620,000	
12. Total Region Cost Per Acre	$73.92	

Operational Costs by Region

Delphi Region - 8 - Georgia, East

Acres of Cotton (1974-78 average) 92,612

	Cost x 1000	
	1984-85	1985-86
1. Personnel, Including benefits		
(a) Fulltime		
1. USDA 2.0 MY	56	56
2. STATE/USDA 24.0 MY	492	492
(b) Temporary (State) 37.2 MY	326	326
2. Sterile Weevils		
(a) Rearing @2.20/1000	0	81
(b) Dispersal @2.20/A	0	204
3. Chemicals - Diapause Control beginning 1st week in Sept. 1st year (Guthion or Malathion)		
(a) Number of treatments: 8 @ 1.80 /A	1,334	0
(b) Application 8 treatments @1.50 /A	1,111	0
(c) Dimilin followup as needed for remainder of program, estimated at 25% of acreage-cost per acre, 4 treatments including Dimilin, Oil and Application 26.82/A	0	621
(d) Cleanup treatment following Dimilin, Guthion and application - 3.64/A	0	84
4. Traps - (a) Survey and infield-average of 1 trap/A-trap 83¢, service 16 times @16⅔¢ ea (3.47/A)	321	321
5. Measure Cotton @1.00/A	93	93
6. Vehicle Operation 2.48/A	230	230
7. Misc.(phone, rent, travel, training, move personnel,etc.) 2.09/A	194	194
8. Regulatory 1.10/A	102	102
9. Total Cost Per Year	4,259	2,804
10. Cost Per Acre	$45.99	$30.28
11. Total Region Cost	7,063,000	
12. Total Region Cost Per Acre	$76.26	

Operational Costs by Region

Delphi Region - 9 - Georgia, Southwest

Acres of Cotton (1974-78 average) 111,104

	Cost x 1000	
	1984-85	1985-86
1. Personnel, Including benefits		
(a) Fulltime		
1. USDA 2.4 MY -	67	67
2. STATE/USDA 2.8 MY - - - - - - - - - - - - - - - - - -	575	575
(b) Temporary (State) 44.4 MY - - - - - - - - - - - - - - - -	392	392
2. Sterile Weevils		
(a) Rearing @2.20/1000 -	0	98
(b) Dispersal @2.20/A -	0	244
3. Chemicals - Diapause Control beginning 1st week in Sept. 1st year (Guthion or Malathion)		
(a) Number of treatments: 9 @ 1.80 /A - - - - - - - - - -	1800	0
(b) Application 9 treatments @1.47 /A - - - - - - - - - -	1470	0
(c) Dimilin followup as needed for remainder of program, estimated at 25% of acreage-cost per acre, 4 treatments including Dimilin, Oil and Application 26.79/A - - - - - - - -	0	744
(d) Cleanup treatment following Dimilin, Guthion and application - 3.64/A - - - - - - - - - - - - - - - - - -	0	101
4. Traps -		
(a) Survey and infield-average of 1 trap/A-trap 83¢, service 16 times @16½¢ ea (3.47/A)- - - - - - - - - - - - - - - - -	386	386
5. Measure Cotton @1.00/A -	111	111
6. Vehicle Operation 2.48/A - - - - - - - - - - - - - - - - - - -	276	276
7. Misc.(phone, rent, travel, training, move personnel,etc.) 2.09/A- -	232	232
8. Regulatory 1.10/A -	122	122
9. Total Cost Per Year -	5,431	3,348
10. Cost Per Acre -	$48.88	$30.13
11. Total Region Cost -	8,779,000	
12. Total Region Cost Per Acre - - - - - - - - - - - - - - - - - -	$79.02	

Operational Costs by Region

Delphi Region - 10 - Alabama, Limestone Valley

Acres of Cotton (1974-78 average) 264,419

	Cost x 1000	
1. Personnel, Including benefits	1984-85	1985-86
(a) Fulltime		
1. USDA 5.6 MY	160	160
2. STATE/USDA 54.0 MY	1096	1096
(b) Temporary (State) 105.6 MY	931	931
2. Sterile Weevils		
(a) Rearing @2.20/1000	0	233
(b) Dispersal @2.20/A	0	582
3. Chemicals - Diapause Control beginning 1st week in Sept. 1st year (Guthion or Malathion)		
(a) Number of treatments: 6 @ 1.81 /A	2,872	0
(b) Application 6 treatments @1.48 /A	2,348	0
(c) Dimilin followup as needed for remainder of program, estimated at 25% of acreage-cost per acre, 4 treatments including Dimilin, Oil and Application 26.44/A	0	1,748
(d) Cleanup treatment following Dimilin, Guthion and application - 3.57/A	0	236
4. Traps - (a) Survey and infield-average of 1 trap/A-trap 83¢, service 16 times @16½¢ ea (3.47/A)	918	918
5. Measure Cotton @1.00/A	264	264
6. Vehicle Operation 2.48/A	656	656
7. Misc.(phone, rent, travel, training, move personnel,etc.) 2.09/A	553	553
8. Regulatory 1.10/A	291	291
9. Total Cost Per Year	10,089	7,668
10. Cost Per Acre	$38.16	$29.00
11. Total Region Cost	17,757,000	
12. Total Region Cost Per Acre	$67.16	

Operational Costs by Region

Delphi Region - 11 - Alabama, South

Acres of Cotton (1974-78 average) 173,889

	Cost x 1000	
	1984-85	1985-8
1. Personnel, Including benefits		
(a) Fulltime		
1. USDA 3.7 MY -	105	105
2. STATE/USDA 44.0 MY - - - - - - - - - - - - - - - - - -	900	900
(b) Temporary (State) 69.6 MY - - - - - - - - - - - - - - - -	612	612
2. Sterile Weevils		
(a) Rearing @2.20/1000 -	0	153
(b) Dispersal @2.20/A -	0	383
3. Chemicals - Diapause Control, beginning 1st week in Sept. 1st year (Guthion or Malathion)		
(a) Number of treatments: 9 @ 1.80/A - - - - - - - - - - -	2,817	0
(b) Application 9 treatments @ 1.24/A - - - - - - - - - - -	2,473	0
(c) Dimilin followup as needed for remainder of program, estimated at 25% of acreage-cost per acre, 4 treatments including Dimilin, Oil and Application 26.80/A - - - - - - - -	0	1,165
(d) Cleanup treatment following Dimilin, Guthion and application - 3.61/A - - - - - - - - - - - - - - - - - -	0	157
4. Traps -		
(a) Survey and infield-average of 1 trap/A-trap 83¢, service 16 times @16½¢ ea (3.47/A)- - - - - - - - - - - - - - - - - -	603	603
5. Measure Cotton @1.00/A -	174	174
6. Vehicle Operation 2.75/A -	478	478
7. Misc.(phone, rent, travel, training, move personnel,etc.) 2.09/A- -	363	363
8. Regulatory 1.10/A -	191	191
9. Total Cost Per Year -	8,716	5,284
10. Cost Per Acre -	$50.12	$30.39
11. Total Region Cost -	14,000,000	
12. Total Region Cost Per Acre -	$80.51	

Operational Costs by Region

Delphi Region- 12 - Tennessee, North Brown Loam

Acres of Cotton (1974-78 average) 137,986

	Cost x 1000	
	1985-86	1986-87
1. Personnel, Including benefits		
(a) Fulltime		
1. USDA 2.1 MY	56	56
2. STATE/USDA 29.0 MY	594	594
(b) Temporary (State) 55.2 MY	486	486
2. Sterile Weevils		
(a) Rearing @2.20/1000	0	121
(b) Dispersal @2.20/A	0	304
3. Chemicals - Diapause Control beginning 1st week in Sept. 1st year (Guthion or Malathion)		
(a) Number of treatments: 7 @ 1.80 /A	1,739	0
(b) Application 7 treatments @1.47 /A	1,420	0
(c) Dimilin followup as needed for remainder of program, estimated at 25% of acreage-cost per acre, 4 treatments including Dimilin, Oil and Application 26.44/A	0	912
(d) Cleanup treatment following Dimilin, Guthion and application 3.60/A	0	124
4. Traps - (a) Survey and infield-average of 1 trap/A-trap 83¢, service 16 times @16½¢ ea (3.47/A)	479	479
5. Measure Cotton @1.00/A	138	138
6. Vehicle Operation 2.43/A	335	335
7. Misc.(phone, rent, travel, training, move personnel,etc.) 2.09/A	288	288
8. Regulatory 1.10/A	152	152
9. Total Cost Per Year	5,687	3,989
10. Cost Per Acre	$41.21	$28.91
11. Total Region Cost	9,676,000	
12. Total Region Cost Per Acre	$70.12	

Operational Costs by Region

Delphi Region - 13 - Tennessee, South Brown Loam

Acres of Cotton (1974-78 average) 89,899

	Cost x 1000	
	1985-86	1986-8
1. Personnel, Including benefits		
(a) Fulltime		
1. USDA 1.5 MY	38	38
2. STATE/USDA 23.0 MY	473	473
(b) Temporary (State) 36.0 MY	317	317
2. Sterile Weevils		
(a) Rearing @2.20/1000	0	79
(b) Dispersal @2.20/A	0	198
3. Chemicals - Diapause Control beginning 1st week in Sept. 1st year (Guthion or Malathion)		
(a) Number of treatments: 8 @ 1.82/A	1,295	0
(b) Application 8 treatments @ 1.49/A	1,057	0
(c) Dimilin followup as needed for remainder of program, estimated at 25% of acreage-cost per acre, 4 treatments including Dimilin, Oil and Application 26.79/A	0	602
(d) Cleanup treatment following Dimilin, Guthion and application - 3.60/A	0	81
4. Traps - (a) Survey and infield-average of 1 trap/A-trap 83¢, service 16 times @16½¢ ea (3.47/A)	312	312
5. Measure Cotton @1.00/A	90	90
6. Vehicle Operation 2.75/A	247	247
7. Misc.(phone, rent, travel, training, move personnel,etc.) 2.09/A	188	188
8. Regulatory 1.10/A	99	99
9. Total Cost Per Year	4,116	2,724
10. Cost Per Acre	$45.79	$30.30
11. Total Region Cost	6,840,000	
12. Total Region Cost Per Acre	$76.09	

Operational Costs by Region

Delphi Region - 14 - Missouri, Bootheel

[redacted] cres of cotton (1974-78 average) Any acreage which requires attention will be covered by funding from Delphi Regions 12 and 19. [redacted]

Cost x 1000

1. Personnel, Including benefits
   (a) Fulltime
      1. USDA _____MY -
      2. STATE/USDA _____MY - - - - - - - - - - - - - - - - - -

   (b) Temporary (State) _____MY - - - - - - - - - - - - - - - - -

2. Sterile Weevils
   (a) Rearing @2.20/1000 -
   (b) Dispersal @2.20/A -

3. Chemicals - Diapause Control beginning 1st week in Sept. 1st year (Guthion or Malathion)
   (a) Number of treatments: _____@ /A - - - - - - - - - - -
   (b) Application _____treatments @ /A - - - - - - - - - - -
   (c) Dimilin followup as needed for remainder of program, estimated at 25% of acreage-cost per acre, 4 treatments including Dimilin, Oil and Application _____ - - - - - - - -
   (d) Cleanup treatment following Dimilin, Guthion and application - _____ - - - - - - - - - - - - - - - - -

4. Traps -
   (a) Survey and infield-average of 1 trap/A-trap 83¢, service 16 times @16½¢ ea (3.47/A)- - - - - - - - - - - - - - - - - -

5. Measure Cotton @1.00/A -

6. Vehicle Operation _____ -

7. Misc.(phone, rent, travel, training, move personnel,etc.) 2.09/A- -

8. Regulatory 1.10/A- -

9. Total Cost Per Year -

[redacted] Per Acre -

1. [redacted] Region Cost -

2. [redacted] Region Cost Per Acre - - - - - - - - - - - - - - - - - - [redacted]

Operational Costs by Region

Delphi Region - 15 - Mississippi, Northeast

Acres of Cotton (1974-78 average) 94,705

	Cost x 1000	
	1985-86	1986-8
1. Personnel, Including benefits		
(a) Fulltime		
1. USDA 1.5 MY	38	38
2. STATE/USDA 24.0 MY	492	492
(b) Temporary (State) 37.9 MY	333	333
2. Sterile Weevils		
(a) Rearing @2.20/1000	0	83
(b) Dispersal @2.20/A	0	208
3. Chemicals - Diapause Control beginning 1st week in Sept. 1st year (Guthion or Malathion)		
(a) Number of treatments: 8 @ 1.80/A	1,364	0
(b) Application 8 treatments @ 1.53/A	1,197	0
(c) Dimilin followup as needed for remainder of program, estimated at 25% of acreage-cost per acre, 4 treatments including Dimilin, Oil and Application 26.74/A	0	633
(d) Cleanup treatment following Dimilin, Guthion and application - 3.59/A	0	85
4. Traps -		
(a) Survey and infield-average of 1 trap/A-trap 83¢, service 16 times @16⅔¢ ea (3.47/A)	329	329
5. Measure Cotton @1.00/A	95	95
6. Vehicle Operation 2.75/A	260	260
7. Misc.(phone, rent, travel, training, move personnel,etc.) 2.09/A	198	198
8. Regulatory 1.10/A	104	104
9. Total Cost Per Year	4,410	2,858
10. Cost Per Acre	$46.57	$30.1
11. Total Region Cost	7,268,000	
12. Total Region Cost Per Acre	$76.74	

Operational Costs by Region

Delphi Region - 16 - Mississippi, Northcentral

Acres of Cotton (1974-78 average) 201,460

	Cost x 1000	
	1985-86	1986-87
1. Personnel, Including benefits		
(a) Fulltime		
1. USDA 3.1 MY	81	81
2. STATE/USDA 5.0 MY	1,021	1,021
(b) Temporary (State) 80.6 MY	710	710
2. Sterile Weevils		
(a) Rearing @2.20/1000	0	177
(b) Dispersal @2.20/A	0	443
3. Chemicals - Diapause Control beginning 1st week in Sept. 1st year (Guthion or Malathion)		
(a) Number of treatments: 8 @ 1.80 /A	2,901	0
(b) Application 8 treatments @1.58 /A	2,546	0
(c) Dimilin followup as needed for remainder of program, estimated at 25% of acreage-cost per acre, 4 treatments including Dimilin, Oil and Application 26.69/A	0	1,344
(d) Cleanup treatment following Dimilin, Guthion and application - 3.59/A	0	181
4. Traps - (a) Survey and infield-average of 1 trap/A-trap 83¢, service 16 times @16½¢ ea (3.47/A)	699	699
5. Measure Cotton @1.00/A	201	201
6. Vehicle Operation 2.75/A	554	554
7. Misc.(phone, rent, travel, training, move personnel,etc.) 2.09/A	421	421
8. Regulatory 1.10/A	222	222
9. Total Cost Per Year	9,356	6,054
10. Cost Per Acre	$46.44	$30.05
11. Total Region Cost	15,410,000	
12. Total Region Cost Per Acre	$76.49	

Operational Costs by Region

Delphi Region - 17 - Mississippi, Delta

Acres of Cotton (1974-78 average) 895,960

	Cost x 1000	
	1986-87	1987-8
1. Personnel, Including benefits		
(a) Fulltime		
1. USDA 10.8 MY	272	272
2. STATE/USDA 142.0 MY	2,914	2,914
(b) Temporary (State) 358.4 MY	3,154	3,154
2. Sterile Weevils		
(a) Rearing @2.20/1000	0	788
(b) Dispersal @2.20/A	0	1,971
3. Chemicals - Diapause Control beginning 1st week in Sept. 1st year (Guthion or Malathion)		
(a) Number of treatments: 5 @ 1.81 /A	8,108	0
(b) Application 5 treatments @1.37 /A	6,137	0
(c) Dimilin followup as needed for remainder of program, estimated at 25% of acreage-cost per acre, 4 treatments including Dimilin, Oil and Application 26.08/A	0	5,842
(d) Cleanup treatment following Dimilin, Guthion and application - 3.53/A	0	791
4. Traps -		
(a) Survey and infield-average of 1 trap/A-trap 83¢, service 16 times @16½¢ ea (3.47/A)	3,109	3,109
5. Measure Cotton @1.00/A	896	896
6. Vehicle Operation 2.20/A	1,971	1,971
7. Misc.(phone, rent, travel, training, move personnel,etc.) 2.09/A	1,873	1,873
8. Regulatory 1.10/A	986	986
9. Total Cost Per Year	29,420	24,567
10. Cost Per Acre	$32.84	$27.4
11. Total Region Cost	$3,987,000	
12. Total Region Cost Per Acre	$60.26	

Operational Costs by Region

Delphi Region - 18 - Mississippi, Southern

Acres of Cotton (1974-78 average) 208,592

	Cost x 1000	
	1985-86	1986-8
1. Personnel, Including benefits		
(a) Fulltime		
1. USDA 3.2 MY -	84	84
2. STATE/USDA 51.0 MY - - - - - - - - - - - - - - - - - -	1,040	1,040
(b) Temporary (State) 83.4 MY - - - - - - - - - - - - - - - - -	734	734
2. Sterile Weevils		
(a) Rearing @2.20/1000 -	0	184
(b) Dispersal @2.20/A -	0	459
3. Chemicals - Diapause Control beginning 1st week in Sept. 1st year (Guthion or Malathion)		
(a) Number of treatments: 9 @ 1.80 /A - - - - - - - - - -	3,379	0
(b) Application 9 treatments @ 1.36/A - - - - - - - - - -	2,553	0
(c) Dimilin followup as needed for remainder of program, estimated at 25% of acreage-cost per acre, 4 treatments including Dimilin, Oil and Application 26.67/A - - - - - - - -	0	1,391
(d) Cleanup treatment following Dimilin, Guthion and application - 3.61/A - - - - - - - - - - - - - - - - - -	0	188
4. Traps -		
(a) Survey and infield-average of 1 trap/A-trap 83¢, service 16 times @16½¢ ea (3.47/A)- - - - - - - - - - - - - - - - - -	724	724
5. Measure Cotton @1.00/A -	209	209
6. Vehicle Operation 2.75/A -	574	574
7. Misc.(phone, rent, travel, training, move personnel,etc.) 2.09/A- -	436	436
8. Regulatory 1.10/A -	229	229
9. Total Cost Per Year -	9,962	6,252
10. Cost Per Acre -	$47.76	$29.9
11. Total Region Cost -	16,214,000	
12. Total Region Cost Per Acre - - - - - - - - - - - - - - - - - - -	$77.73	

Operational Costs by Region

Delphi Region - 19 - Arkansas, Northeast

Acres of Cotton (1974-78 average) 458,354

	Cost x 1000	
	1985-86	1986-
1. Personnel, Including benefits		
(a) Fulltime		
1. USDA 7.1 MY	182	182
2. STATE/USDA 80.0 MY	1,626	1,626
(b) Temporary (State) 183.3 MY	1,614	1,614
2. Sterile Weevils		
(a) Rearing @2.20/1000	0	403
(b) Dispersal @2.20/A	0	1,008
3. Chemicals - Diapause Control beginning 1st week in Sept. 1st year (Guthion or Malathion)		
(a) Number of treatments: 6 @ 1.82 /A	5,005	0
(b) Application 6 treatments @ 1.36/A	3,740	0
(c) Dimilin followup as needed for remainder of program, estimated at 25% of acreage-cost per acre, 4 treatments including Dimilin, Oil and Application 26.20/A	0	3,002
(d) Cleanup treatment following Dimilin, Guthion and application - 3.54/A	0	406
4. Traps -		
(a) Survey and infield-average of 1 trap/A-trap 83¢, service 16 times @16½¢ ea (3.47/A)	1,590	1,590
5. Measure Cotton @1.00/A	458	458
6. Vehicle Operation 2.48/A	1,137	1,137
7. Misc.(phone, rent, travel, training, move personnel,etc.) 2.09/A	958	958
8. Regulatory 1.10/A	504	504
9. Total Cost Per Year	16,814	12,888
10. Cost Per Acre	$36.68	$28.1
11. Total Region Cost	29,702,000	
12. Total Region Cost Per Acre	$64.80	

Operational Costs by Region

Delphi Region - 20 - Arkansas, Southeast

Acres of Cotton (1974-78 average) 472,220

	Cost x 1000	
	1986-87	1987-8
1. Personnel, Including benefits		
(a) Fulltime		
1. USDA 5.7 MY	143	139
2. STATE/USDA 105.0 MY	2,128	2,128
(b) Temporary (State) 188.8 MY	1,662	1,662
2. Sterile Weevils		
(a) Rearing @2.20/1000	0	416
(b) Dispersal @2.20/A	0	1,039
3. Chemicals - Diapause Control beginning 1st week in Sept. 1st year (Guthion or Malathion)		
(a) Number of treatments: 8 @ 1.80 /A	6,800	0
(b) Application 8 treatments @1.36 /A	5,138	0
(c) Dimilin followup as needed for remainder of program, estimated at 25% of acreage-cost per acre, 4 treatments including Dimilin, Oil and Application 26.47/A	0	3,125
(d) Cleanup treatment following Dimilin, Guthion and application - 3.58/A	0	423
4. Traps - (a) Survey and infield-average of 1 trap/A-trap 83¢, service 16 times @16½¢ ea (3.47/A)	1,639	1,639
5. Measure Cotton @1.00/A	472	472
6. Vehicle Operation 2.48/A	1,171	1,171
7. Misc.(phone, rent, travel, training, move personnel,etc.) 2.09/A	987	987
8. Regulatory 1.10/A	519	519
9. Total Cost Per Year	20,659	13,720
10. Cost Per Acre	$43.75	$29.
11. Total Region Cost	34,379,0	
12. Total Region Cost Per Acre	72.80	

Operational Costs by Region

Delphi Region - 21 - Louisiana, Northeast

Acres of Cotton (1974-78 average) 434,690

	Cost x 1000	
	1987-88	1988-89
1. Personnel, Including benefits		
(a) Fulltime		
1. USDA 14.0 MY	343	343
2. STATE/USDA 109.0 MY	2,228	2,228
(b) Temporary (State) 114.0 MY	1,530	1,530
2. Sterile Weevils		
(a) Rearing @2.20/1000	0	383
(b) Dispersal @2.20/A	0	956
3. Chemicals - Diapause Control beginning 1st week in Sept. 1st year (Guthion or Malathion)		
(a) Number of treatments: 9 @ 1.80/A	7,042	0
(b) Application 9 treatments @ 1.58/A	6,181	0
(c) Dimilin followup as needed for remainder of program, estimated at 25% of acreage-cost per acre, 4 treatments including Dimilin, Oil and Application 26.82/A	0	2,915
(d) Cleanup treatment following Dimilin, Guthion and application - 3.64/A	0	396
4. Traps - (a) Survey and infield-average of 1 trap/A-trap 83¢, service 16 times @16½¢ ea (3.47/A)	1,508	1,508
5. Measure Cotton @1.00/A	435	435
6. Vehicle Operation 2.48/A	1,078	1,078
7. Misc.(phone, rent, travel, training, move personnel,etc.) 2.09/A	909	909
8. Regulatory 1.10/A	478	478
9. Total Cost Per Year	21,732	15,153
10. Cost Per Acre	$49.99	$30.27
11. Total Region Cost	$4,891,000	
12. Total Region Cost Per Acre	$80.27	

Operational Costs by Region

Delphi Region - 22 - Louisiana, Red River

Acres of Cotton (1974-78 average) 77,565

	Cost x 1000	
	1987-88	1988-89
1. Personnel, Including benefits		
(a) Fulltime		
1. USDA 2.5 MY	61	61
2. STATE/USDA 20.0 MY	409	409
(b) Temporary (State) 31.2 MY	273	273
2. Sterile Weevils		
(a) Rearing @2.20/1000	0	68
(b) Dispersal @2.20/A	0	171
3. Chemicals - Diapause Control beginning 1st week in Sept. 1st year (Guthion or Malathion)		
(a) Number of treatments: 9 @ 1.80/A	1,257	0
(b) Application 9 treatments @ 1.58/A	1,103	0
(c) Dimilin followup as needed for remainder of program, estimated at 25% of acreage-cost per acre, 4 treatments including Dimilin, Oil and Application 26.92/A	0	522
(d) Cleanup treatment following Dimilin, Guthion and application - 3.66/A	0	71
4. Traps - (a) Survey and infield-average of 1 trap/A-trap 83¢, service 16 times @16½¢ ea (3.47/A)	269	269
5. Measure Cotton @1.00/A	78	78
6. Vehicle Operation 2.75/A	213	213
7. Misc.(phone, rent, travel, training, move personnel,etc.) 2.09/A	162	162
8. Regulatory 1.10/A	85	85
9. Total Cost Per Year	3,910	2,382
10. Cost Per Acre	$50.41	$30.7
11. Total Region Cost	6,292,000	
12. Total Region Cost Per Acre	$81.12	

Operational Costs by Region

Delphi Region - 23 - Texas, Rio Grande Valley

Acres of Cotton (1974-78 average) 278,820

	Cost x 1000	
	1990-91	1991-92
1. Personnel, Including benefits		
(a) Fulltime		
1. USDA 11.0 MY	269	269
2. STATE/USDA 25.0 MY	1,348	1,348
(b) Temporary (State) 111.6 MY	981	981
2. Sterile Weevils		
(a) Rearing @2.20/1000	0	245
(b) Dispersal @2.20/A	0	613
3. Chemicals - Diapause Control beginning 1st week in Sept. 1st year (Guthion or Malathion)		
(a) Number of treatments: 10 @ 1.79/A	4,991	0
(b) Application 10 treatments @ 1.79/A	4,991	0
(c) Dimilin followup as needed for remainder of program, estimated at 25% of acreage-cost per acre, 4 treatments including Dimilin, Oil and Application 26.79/A	0	1,867
(d) Cleanup treatment following Dimilin, Guthion and application - 3.63/A	0	253
4. Traps -		
(a) Survey and infield-average of 1 trap/A-trap 83¢, service 16 times @16½¢ ea (3.47/A)	968	968
5. Measure Cotton @1.00/A	279	279
6. Vehicle Operation 2.48/A	691	691
7. Misc.(phone, rent, travel, training, move personnel,etc.) 2.09/A	583	583
8. Regulatory 1.10/A	307	307
9. Total Cost Per Year	15,408	8,404
10. Cost Per Acre	$55.26	$30.14
11. Total Region Cost	23,812,000	
12. Total Region Cost Per Acre	$85.40	

Operational Costs by Region

Delphi Region - 24 - Texas, Lower Bend

Acres of Cotton (1974-78 average) 118,849

	Cost x 1000	
	1990-91	1991-92
1. Personnel, Including benefits		
(a) Fulltime		
1. USDA 4.7 MY	115	115
2. STATE/USDA 25.0 MY	511	511
(b) Temporary (State) 47.6 MY	418	418
2. Sterile Weevils		
(a) Rearing @2.20/1000	0	105
(b) Dispersal @2.20/A	0	261
3. Chemicals - Diapause Control beginning 1st week in Sept. 1st year (Guthion or Malathion)		
(a) Number of treatments: 7 @ 1.80/A	1,497	0
(b) Application 7 treatments @ 1.58/A	1,314	0
(c) Dimilin followup as needed for remainder of program, estimated at 25% of acreage-cost per acre, 4 treatments including Dimilin, Oil and Application 26.66/A	0	792
(d) Cleanup treatment following Dimilin, Guthion and application - 3.60/A	0	107
4. Traps - (a) Survey and infield-average of 1 trap/A-trap 83¢, service 16 times @16⅔¢ ea (3.47/A)	412	412
5. Measure Cotton @1.00/A	119	119
6. Vehicle Operation 2.20/A	261	261
7. Misc.(phone, rent, travel, training, move personnel,etc.) 2.09/A	248	248
8. Regulatory 1.10/A	131	131
9. Total Cost Per Year	5,026	5,480
10. Cost Per Acre	$42.29	$29.28
11. Total Region Cost	8,506,000	
12. Total Region Cost Per Acre	$71.57	

Operational Costs by Region

Delphi Region - 25 - Texas, Upper Bend

Acres of Cotton (1974-78 average) 89,639

	Cost x 1000	
	1988-89	1989-90
1. Personnel, Including benefits		
(a) Fulltime		
1. USDA 2.4 MY	58	58
2. STATE/USDA 18.0 MY	363	363
(b) Temporary (State) 36.0 MY	316	316
2. Sterile Weevils		
(a) Rearing @2.20/1000	0	79
(b) Dispersal @2.20/A	0	197
3. Chemicals - Diapause Control beginning 1st week in Sept. 1st year (Guthion or Malathion)		
(a) Number of treatments: 7 @ 1.80/A	1,129	0
(b) Application 7 treatments @ 1.58/A	991	0
(c) Dimilin followup as needed for remainder of program, estimated at 25% of acreage-cost per acre, 4 treatments including Dimilin, Oil and Application 26.42/A	0	592
(d) Cleanup treatment following Dimilin, Guthion and application - 3.57/A	0	80
4. Traps -		
(a) Survey and infield-average of 1 trap/A-trap 83¢, service 16 times @16⅔¢ ea (3.47/A)	311	311
5. Measure Cotton @1.00/A	90	90
6. Vehicle Operation 2.75/A	247	247
7. Misc.(phone, rent, travel, training, move personnel,etc.) 2.09/A	187	187
8. Regulatory 1.10/A	99	99
9. Total Cost Per Year	3,791	2,619
10. Cost Per Acre	$42.29	$29.22
11. Total Region Cost	6,410,000	
12. Total Region Cost Per Acre	$71.51	

Operational Costs by Region

Delphi Region - 26 - Texas, Winter Garden

Acres of Cotton (1974-78 average) 20,416

		Cost x 1000	
		1990-91	1991-92
1.	Personnel, Including benefits		
	(a) Fulltime		
	1. USDA 0.8 MY	20	20
	2. STATE/USDA 5.0 MY	102	102
	(b) Temporary (State) 8.0 MY	72	72
2.	Sterile Weevils		
	(a) Rearing @2.20/1000	0	18
	(b) Dispersal @2.20/A	0	45
3.	Chemicals - Diapause Control beginning 1st week in Sept. 1st year (Guthion or Malathion)		
	(a) Number of treatments: 10 @ 1.79 /A	365	0
	(b) Application 10 treatments @1.79 /A	365	0
	(c) Dimilin followup as needed for remainder of program, estimated at 25% of acreage-cost per acre, 4 treatments including Dimilin, Oil and Application 26.84/A	0	137
	(d) Cleanup treatment following Dimilin, Guthion and application - 3.72/A	0	19
4.	Traps - (a) Survey and infield-average of 1 trap/A-trap 83¢, service 16 times @16½¢ ea (3.47/A)	71	71
5.	Measure Cotton @1.00/A	20	20
6.	Vehicle Operation 2.48/A	51	51
7.	Misc.(phone, rent, travel, training, move personnel,etc.) 2.09/A	43	43
8.	Regulatory 1.10/A	22	22
9.	Total Cost Per Year	1,131	620
10.	Cost Per Acre	$55.40	$30.3
11.	Total Region Cost	1,751,000	
12.	Total Region Cost Per Acre	$85.77	

Operational Costs by Region

Delphi Region - 27 - Texas, Central River

Acres of Cotton (1974-78 average) 47,801

	Cost x 1000	
	1988-89	1989-9(
1. Personnel, Including benefits		
(a) Fulltime		
1. USDA 1.3 MY -	31	31
2. STATE/USDA 12.0 MY - - - - - - - - - - - - - - - - -	187	187
(b) Temporary (State) 19.2 MY - - - - - - - - - - - - - - - -	168	168
2. Sterile Weevils		
(a) Rearing @2.20/1000 -	0	42
(b) Dispersal @2.20/A -	0	105
3. Chemicals - Diapause Control, beginning 1st week in Sept. 1st year (Guthion or Malathion)		
(a) Number of treatments: 10 @ 1.79/A - - - - - - - - - -	856	0
(b) Application 10 treatments @ 1.79/A - - - - - - - - - -	856	0
(c) Dimilin followup as needed for remainder of program, estimated at 25% of acreage-cost per acre, 4 treatments including Dimilin, Oil and Application 26.44/A - - - - - - - -	0	316
(d) Cleanup treatment following Dimilin, Guthion and application - 3.52/A - - - - - - - - - - - - - - - - - -	0	42
4. Traps -		
(a) Survey and infield-average of 1 trap/A-trap 83¢, service 16 times @16½¢ ea (3.47/A)- - - - - - - - - - - - - - - - -	166	166
5. Measure Cotton @1.00/A -	48	48
6. Vehicle Operation 2.75/A -	131	131
7. Misc.(phone, rent, travel, training, move personnel, etc.) 2.09/A- -	100	100
8. Regulatory 1.10/A -	53	53
9. Total Cost Per Year -	2,596	1,389
10. Cost Per Acre -	$54.31	$29.0
11. Total Region Cost -	3,985,000	
12. Total Region Cost Per Acre - - - - - - - - - - - - - - - - - - -	83.37	

Operational Costs by Region

Delphi Region - 28 - Texas, Blackland

Acres of Cotton (1974-78 average) 484,460

	Cost x 1000	
	1988-89	1989-90
1. Personnel, Including benefits		
(a) Fulltime		
1. USDA 12.8 MY	315	315
2. STATE/USDA 97.0MY	1,953	1,953
(b) Temporary (State) 193.6MY	1,705	1,705
2. Sterile Weevils		
(a) Rearing @2.20/1000	0	426
(b) Dispersal @2.20/A	0	1,066
3. Chemicals - Diapause Control beginning 1st week in Sept. 1st year (Guthion or Malathion)		
(a) Number of treatments: 6 @ 1.81/A	5,261	0
(b) Application 6 treatments @ 1.59/A	4,622	0
(c) Dimilin followup as needed for remainder of program, estimated at 25% of acreage-cost per acre, 4 treatments including Dimilin, Oil and Application 26.43/A	0	3,201
(d) Cleanup treatment following Dimilin, Guthion and application - 3.58	0	433
4. Traps - (a) Survey and infield-average of 1 trap/A-trap 83¢, service 16 times @16½¢ ea (3.47/A)	1,681	1,681
5. Measure Cotton @1.00/A	484	484
6. Vehicle Operation 2.48/A	1,201	1,201
7. Misc.(phone, rent, travel, training, move personnel,etc.) 2.09/A	1,013	1,013
8. Regulatory 1.10/A	533	533
9. Total Cost Per Year	18,768	14,011
10. Cost Per Acre	$38.74	$28.92
11. Total Region Cost	$32,779,000	
12. Total Region Cost Per Acre	$67.66	

Operational Costs by Region

Delphi Region - 29 - Texas, Rolling Plains

Acres of Cotton (1974-78 average) 946,081

	Cost x 1000	
	1989-90	1990-9
1. Personnel, Including benefits		
(a) Fulltime		
1. USDA 12.6 MY	309	309
2. STATE/USDA 162.0 MY	3,263	3,263
(b) Temporary (State) 378.4 MY	3,330	3,330
2. Sterile Weevils		
(a) Rearing @2.20/1000	0	833
(b) Dispersal @2.20/A	0	2,081
3. Chemicals - Diapause Control beginning 1st week in Sept. 1st year (Guthion or Malathion)		
(a) Number of treatments: 6 @ 1.80 /A	10,218	0
(b) Application 6 treatments @1.36 /A	7,720	0
(c) Dimilin followup as needed for remainder of program, estimated at 25% of acreage-cost per acre, 4 treatments including Dimilin, Oil and Application 26.15/A.	0	6,184
(d) Cleanup treatment following Dimilin, Guthion and application - 3.54/A	0	837
4. Traps -		
(a) Survey and infield-average of 1 trap/A-trap 83¢, service 16 times @16½¢ ea (3.47/A)	3,283	3,283
5. Measure Cotton @1.00/A	946	946
6. Vehicle Operation 2.20/A	2,081	2,081
7. Misc.(phone, rent, travel, training, move personnel,etc.) 2.09/A	1,977	1,977
8. Regulatory 1.10/A	1,041	1,041
9. Total Cost Per Year	34,168	26,165
10. Cost Per Acre	$36.12	$27.66
11. Total Region Cost	60,333,000	
12. Total Region Cost Per Acre	$63.77	

Operational Costs by Region

Delphi Region - 30 - Texas, High Plains

Acres of Cotton (1974-78 average) Uninfested

	Cost x 1000
1. Personnel, Including benefits	
(a) Fulltime	
1. USDA _____MY -	
2. STATE/USDA _____MY -	
(b) Temporary (State) _____MY - - - - - - - - - - - - - - - - - -	
2. Sterile Weevils	
(a) Rearing @2.20/1000 -	
(b) Dispersal @2.20/A -	
3. Chemicals - Diapause Control beginning 1st week in Sept. 1st year (Guthion or Malathion)	
(a) Number of treatments:_____@ /A - - - - - - - - - - -	
(b) Application _____treatments @ /A - - - - - - - - - - -	
(c) Dimilin followup as needed for remainder of program, estimated at 25% of acreage-cost per acre, 4 treatments including Dimilin, Oil and Application _____ - - - - - - - -	
(d) Cleanup treatment following Dimilin, Guthion and application - _____ - - - - - - - - - - - - - - - - - -	
4. Traps -	
(a) Survey and infield-average of 1 trap/A-trap 83¢, service 16 times @16½¢ ea (3.47/A)- - - - - - - - - - - - - - - - - -	
5. Measure Cotton @1.00/A -	
6. Vehicle Operation _____ -	
7. Misc.(phone, rent, travel, training, move personnel,etc.) 2.09/A- -	
8. Regulatory 1.10/A -	
9. Total Cost Per Year -	
10. Cost Per Acre -	
11. Total Region Cost -	
12. Total Region Cost Per Acre -	

Operational Costs by Region

Delphi Region - 32 - Texas, Pecos

Acres of Cotton (1974-78 average) Uninfested

	Cost x 1000
1. Personnel, Including benefits	
(a) Fulltime	
1. USDA _____MY -	
2. STATE/USDA _____MY - - - - - - - - - - - - - - - - -	
(b) Temporary (State) _____MY - - - - - - - - - - - - - - - -	
2. Sterile Weevils	
(a) Rearing @2.20/1000 -	
(b) Dispersal @2.20/A -	
3. Chemicals - Diapause Control beginning 1st week in Sept. 1st year (Guthion or Malathion)	
(a) Number of treatments:_____@ /A - - - - - - - - - -	
(b) Application _____treatments @ /A - - - - - - - - - -	
(c) Dimilin followup as needed for remainder of program, estimated at 25% of acreage-cost per acre, 4 treatments including Dimilin, Oil and Application _____ - - - - - - - -	
(d) Cleanup treatment following Dimilin, Guthion and application - _____ - - - - - - - - - - - - - - - - -	
4. Traps -	
(a) Survey and infield-average of 1 trap/A-trap 83¢, service 16 times @16½¢ ea (3.47/A)- - - - - - - - - - - - - - - -	
5. Measure Cotton @1.00/A -	
6. Vehicle Operation _____ -	
7. Misc.(phone, rent, travel, training, move personnel,etc.) 2.09/A- -	
8. Regulatory 1.10/A -	
9. Total Cost Per Year -	
10. Cost Per Acre -	
11. Total Region Cost -	
12. Total Region Cost Per Acre - - - - - - - - - - - - - - - - - -	

Operational Costs by Region

Delphi Region - 32 - Texas, Pecos

Acres of Cotton (1974-78 average) Uninfested

	Cost x 1000
1. Personnel, Including benefits	
(a) Fulltime	
1. USDA _____MY -	
2. STATE/USDA _____MY - - - - - - - - - - - - - - - - - -	
(b) Temporary (State) _____MY - - - - - - - - - - - - - - - -	
2. Sterile Weevils	
(a) Rearing @2.20/1000 -	
(b) Dispersal @2.20/A -	
3. Chemicals - Diapause Control beginning 1st week in Sept. 1st year (Guthion or Malathion)	
(a) Number of treatments: _____@ /A - - - - - - - - - -	
(b) Application _____treatments @ /A - - - - - - - - - -	
(c) Dimilin followup as needed for remainder of program, estimated at 25% of acreage-cost per acre, 4 treatments including Dimilin, Oil and Application _____ - - - - - - - -	
(d) Cleanup treatment following Dimilin, Guthion and application - _____ - - - - - - - - - - - - - - - - - -	
4. Traps -	
(a) Survey and infield-average of 1 trap/A-trap 83¢, service 16 times @16½¢ ea (3.47/A)- - - - - - - - - - - - - - - - - -	
5. Measure Cotton @1.00/A -	
6. Vehicle Operation _____ -	
7. Misc.(phone, rent, travel, training, move personnel,etc.) 2.09/A- -	
8. Regulatory 1.10/A -	
9. Total Cost Per Year -	
10. Cost Per Acre -	
11. Total Region Cost -	
12. Total Region Cost Per Acre -	

Operational Costs by Region

Delphi Region - 33 - Texas, El Paso

Acres of Cotton (1974-78 average) Uninfested

	Cost x 1000
1. Personnel, Including benefits	
(a) Fulltime	
1. USDA _____MY -	
2. STATE/USDA _____MY - - - - - - - - - - - - - - - - - -	
(b) Temporary (State) _____MY - - - - - - - - - - - - - - - -	
2. Sterile Weevils	
(a) Rearing @2.20/1000 -	
(b) Dispersal @2.20/A -	
3. Chemicals - Diapause Control beginning 1st week in Sept. 1st year (Guthion or Malathion)	
(a) Number of treatments:_____@ /A - - - - - - - - - -	
(b) Application _____treatments @ /A - - - - - - - - - -	
(c) Dimilin followup as needed for remainder of program, estimated at 25% of acreage-cost per acre, 4 treatments including Dimilin, Oil and Application _____ - - - - - - - -	
(d) Cleanup treatment following Dimilin, Guthion and application - _____ - - - - - - - - - - - - - - - - -	
4. Traps -	
(a) Survey and infield-average of 1 trap/A-trap 83¢, service 16 times @16½¢ ea (3.47/A)- - - - - - - - - - - - - - - - -	
5. Measure Cotton @1.00/A -	
6. Vehicle Operation _____ -	
7. Misc.(phone, rent, travel, training, move personnel,etc.) 2.09/A- -	
8. Regulatory 1.10/A -	
9. Total Cost Per Year -	
10. Cost Per Acre -	
11. Total Region Cost -	
12. Total Region Cost Per Acre - - - - - - - - - - - - - - - - - - -	

Operational Costs by Region

Delphi Region - 34 _ Oklahoma, North

Acres of Cotton (1974-78 average) Any problems which arise will be covered by funds from Delphi Region 35

	Cost x 1000
1. Personnel, Including benefits	
(a) Fulltime	
1. USDA _____MY -	
2. STATE/USDA _____MY - - - - - - - - - - - - - - - - - - -	
(b) Temporary (State) _____MY - - - - - - - - - - - - - - - - -	
2. Sterile Weevils	
(a) Rearing @2.20/1000 -	
(b) Dispersal @2.20/A -	
3. Chemicals - Diapause Control beginning 1st week in Sept. 1st year (Guthion or Malathion)	
(a) Number of treatments: _____@ /A - - - - - - - - - -	
(b) Application _____treatments @ /A - - - - - - - - - -	
(c) Dimilin followup as needed for remainder of program, estimated at 25% of acreage-cost per acre, 4 treatments including Dimilin, Oil and Application _____ - - - - - - - -	
(d) Cleanup treatment following Dimilin, Guthion and application - _____ - - - - - - - - - - - - - - - - - -	
4. Traps -	
(a) Survey and infield-average of 1 trap/A-trap 83¢, service 16 times @16⅔¢ ea (3.47/A)- - - - - - - - - - - - - - - - - -	
5. Measure Cotton @1.00/A -	
6. Vehicle Operation _____ -	
7. Misc.(phone, rent, travel, training, move personnel,etc.) 2.09/A- -	
8. Regulatory 1.10/A -	
9. Total Cost Per Year -	
10. Cost Per Acre -	
11. Total Region Cost -	
12. Total Region Cost Per Acre - - - - - - - - - - - - - - - - - - -	

Operational Costs by Region

Delphi Region - 35 - Oklahoma, South

Acres of Cotton (1974-78 average) 158,477

	Cost x 1000	
	1989-90	1990-91
1. Personnel, Including benefits		
(a) Fulltime		
1. USDA 2.1 MY	52	52
2. STATE/USDA 31.0 MY	623	623
(b) Temporary (State) 63.2 MY	558	558
2. Sterile Weevils		
(a) Rearing @2.20/1000	0	139
(b) Dispersal @2.20/A	0	349
3. Chemicals - Diapause Control, beginning 1st week in Sept. 1st year (Guthion or Malathion)		
(a) Number of treatments: 6 @ 1.81 /A	1,721	0
(b) Application 6 treatments @1.37 /A	1,303	0
(c) Dimilin followup as needed for remainder of program, estimated at 25% of acreage-cost per acre, 4 treatments including Dimilin, Oil and Application 26.30/A	0	1,042
(d) Cleanup treatment following Dimilin, Guthion and application - 3.58/A	0	142
4. Traps - (a) Survey and infield-average of 1 trap/A-trap 83¢, service 16 times @16½¢ ea (3.47/A)	550	550
5. Measure Cotton @1.00/A	158	158
6. Vehicle Operation 2.20/A	349	349
7. Misc.(phone, rent, travel, training, move personnel,etc.) 2.09/A	331	331
8. Regulatory 1.10/A	174	174
9. Total Cost Per Year	5,819	4,467
10. Cost Per Acre	$36.72	$28.1
11. Total Region Cost	10,286,00	
12. Total Region Cost Per Acre	$64.91	

IV. Monitoring Program

This trapping activity will begin the year following completion of eradication operations. The greater trap density in years 1 and 2 is to locate any infestations missed during eradication operations so that appropriate action can be taken to eliminate the infestation before it spreads to greater acreage. The continued surveillance, thereafter, is to detect and destroy, as early as possible, any reinfestation which may occur. The appropriate action in such cases consists of the following activities:

1. When boll weevils are detected in the area where eradication has been completed, the first action will be to delimit or identify the infested area and population levels. Trap density will be increased to 1 acre within an area of 1 to 2 miles radius from the detection site. Visual surveys will be done in the area to determine if reproduction is occurring. Traps and visual surveys will be expanded into additional acreage as needed to delimit the infestation.

2. Judgement, based upon survey results, will be used as to suppression action to be taken. If infestations are found (including reproduction), during the growing season, control measures with Dimilin® and/or O.P. insecticides will be used. If infestations are found late in the season but with adequate time for boll weevils to attain diapause before crop destruction, diapause treatments will be made. No treatments would be made for detections made in late season just prior to crop destruction.

3. During the year following these actions, traps will be used at 1 acre in the area to determine if the infestation has been eradicated.

Generally, it will require 1 MY supervisory for 250,000 to 500,000 acres of cotton. Trappers will handle approximately 1,000 to 2,500 traps depending upon geographical distribution of cotton and trap density.

Trapping will begin the month of planting, usually March or April, depending on location in the Cotton Belt. Traps will be active 3 months in the spring, around cotton fields of the previous season (March-April-May or April-May-June) and again for 3 months in the fall, around current cotton fields (mid-July to mid-October or mid-August to mid-November).

Traps will be serviced and data collected on a 4-week schedule. Trapping rate will be approximately: (a) one (1) trap per 10 acres of cotton the first year after eradication; (b) one (1) trap per 50 acres of ctton the second year, and (c) one (1) trap per 200 acres of cotton the third year. This trap density will be decreased in large open blocks of cotton. Trap density in subsequent years will depend upon the expected hazard of reinfestation, with higher densities in areas adjacent to infestations outside the U.S. and at certain ports of entry.

This monitoring program would be handled cooperatively by PPQ and the State Departments of Agriculture in the same manner as currently done for such pests as Gypsy Moth and fruit flies.

A summary of monitoring costs following eradication by zone and by Delphi region is given in Table 3.

Likely source of boll weevils for reinfestation:

There are two cotton gorwing areas in Mexico which are infested with boll weevils which are the most likely sources of reinfestation. Both of these areas are adjacent to zone 8. The situation in these two areas in 1980 follows:

1. Matamoros-Reynosa area in the lower Rio Grande Valley. This area is adjacent to the Brownsville-Rio Grande City area in the U.S. In 1980, approximately 3,500 acres of cotton are planted within 40 miles of the border. Only 330 of these acres are within 10 miles of the U.S. cotton.

2. Ojinaga-Conchos River area adjacent to Presidio in the U.S. Approximately 8,000 acres of cotton are planted up the Conchos River for 40 miles and up the Rio Grande River for about 90 miles. The nearest cotton in the U.S. to the infested areas in Mexico is in the Presidio area. Cotton planting in Presidio is sporadic-none planted in 1979 but about 200 acres in 1980. Beyond the Presidio area, the nearest cotton in the U.S. is about 100 miles.

Location of containment zones to prevent reinfestation:

In the event the boll weevil is eradicated from the United States, the logical containment zone is along the Mexico-U.S. border, as indicated in fig. 4. However, after plotting 1978 cotton acres by county (the latest figures available) on a map of the boll weevil infested area, it was evident that a second containment area within the Cotton Belt was possible.

This area runs North-South along the western boundaries of Louisiana and Arkansas, and the Eastern edge of Texas and Oklahoma, fig. 4. The only cotton grown within that area in 1978 was a narrow ismus along the Red River. In an East-West direction along the Red River in this area, approximately 6,000 acres of cotton were grown West of the Texas-Arkansas line, for a distance of approximately 75 miles. Even greater distances with no cotton exist between Arkansas and Oklahoma to the North and Louisiana and Texas to the South. It is proposed that an effective barrier zone could be maintained, therein, with a fall diapause program on the cotton, a trap monitoring program and a regulatory program on movement of regulated items, similar to that presently in effect for Pink Bollworm.

Probability of Boll Weevil Reinvasion

The purpose of the monitoring plan outlined herein, is to detect any reinvasion and establishment in an early stage so that the boll weevils can be destroyed before they sprad over a large area. The plan is designed to detect the presence of the boll weevil before spread beyond 200 acres of cotton. The demonstrated efficacy of the pheromone trap gives us confidence that this can be achieved. When boll weevils are detected, the site will be surveyed intensively to delimit the infestation. The infested area plus some buffer acreage around the area would be the target of action to eliminate the infestation. It is expected that such target areas should rarely exceed 2,000-5,000 acres of cotton.

Normal flight dispersal of adult boll weevils is considered to be the most likely means by which reinvasion would occur. Movement by flight of 20-30 miles is common with a few cases of recorded flight up to 60-70 miles. Even so, as indicated above, the most hazardous areas of reinvasion will be the relatively low cotton acreage along the Texas-Mexico border adjacent to infested cotton in Mexico. We feel that cooperative boll weevil suppression work with Mexico in these areas can minimize this hazard.

We consider long-range accidental movement of weevils into the Cotton Belt to be very unlikely. Regulatory measures would prohibit the movement of cotton plants and products which might harbor the boll weevil. The most likely posibilities from this source would be in seed cotton (unginned). This cotton is bulky and rarely moves further than the nearest gin.

Accidental movement of adults in vehicular traffic is a possibility. However, this is most likely to occur at the end of the growing season when populations are high and dispersing. Since our weevil sources are south of the Cotton Belt, it is unlikely these "hitchhikers" would find suitable cotton further north to start a population which could develop into diapause and survive the winter.

Table 3 Cost (X 1000) Summary for Monitoring Program Following Eradication. The last figure in the columns is the continuing cost unless experience proved less trapping was required in the less hazardous areas.

Year	1	2	3	4	5	6	7	8	Total X 1000
1985	117								117
1986	56	291							347
1987	31	116	495						642
1988		59	189	584					863
1989			113	209	232				644
1990				103	98	269			673
1991					52	112	538		1008
1992						58	224	199	839
1993							113	75	604
1994	31	59	113	103	52	58	113	61	590

Table 3 Monitoring Program Costs by Operational Zone and Delphi Regions

	COST X 1000						
	Operational Zone 1	Delphi Regions					
		1	2	3	4	5	6
	261,477A	854A	31,196A	43,337A	10,313A	156,474A	19,303A
(a) Year 1							
(1) Personnel-Professional 1.0 MY	24						
Temporary 5.2 MY	41						
(2) Traps- 26,148 @$1.50(1/10A)	39						
(3) Transportation @$175/MO/MY	13						
TOTAL	117	0.4	13.9	19.4	4.6	69.9	8.6
(b) Year 2							
(1) Personnel-Professional 1.0 MY	24						
Temporary 1.7 MY	13						
(2) Traps- 5,230 @$1.50(1/50A)	8						
(3) Transportation @$350/MO/MY	11						
TOTAL	56	0.2	6.7	9.3	2.2	33.5	4.1
(c) Year 3 and Thereafter							
(1) Personnel-Professional 0.5 MY	12						
Temporary 1.0 MY	8						
(2) Traps- 1,308 @$1.50(1/200A)	2						
(3) Transportation @$525/MO/MY	9						
TOTAL	31	0.1	3.7	5.2	1.2	18.6	2.3

Continued

	COST X 1000					
	Operational Zone 2	Delphi Regions 7	8	9	10	11
	677,470A	35,446A	92,612A	111,104A	264,419A	183,398 173-889A
(a) Year 1						
(1) Personnel-Professional 2.0 MY	48					
Temporary 13.6 MY	108					
(2) Traps- 67,747 @$1.50(1/10A)	102					
(3) Transportation @$175/MO/MY	33					
TOTAL	291	15	40	48	114	75
(b) Year 2						
(1) Personnel-Professional 1.5 MY	36					
Temporary 4.5 MY	35					
(2) Traps- 13,549 @$1.50(1/50A)	20					
(3) Transportation @$350/MO/MY	25					
TOTAL	116	6	16	19	45	30
(c) Year 3 and Thereafter						
(1) Personnel-Professional 1.0 MY	24					
Temporary 1.7 MY	13					
(2) Traps- 3,387 @$1.50(1/200A)	5					
(3) Transportation @$525/MO/MY	17					
TOTAL	59	3	8	10	23	15

COntinued

	COST X 1000						
	Operational Zone 3	Delphi Regions 12	13	15	16	18	19
	1,190,996A	137,986A	89,899A	94,705A	201,460A	208,592A	458,354A
(a) Year 1							
(1) Personnel-Professional 3.0 MY	72						
Temporary 23.8 MY	188						
(2) Traps- 119,099 @$1.50(1/10A)	179						
(3) Transportation @$175/MO/MY	56						
TOTAL	495	57	37	39	84	87	191
(b) Year 2							
(1) Personnel-Professional 2.0 MY	48						
Temporary 7.9 MY	63						
(2) Traps- 23,820 @$1.50(1/50A)	36						
(3) Transportation @$350/MO/MY	42						
TOTAL	189	22	14	15	32	33	73
(c) Year 3 and Thereafter							
(1) Personnel-Professional 2.0 MY	48						
Temporary 3.0 MY	24						
(2) Traps- 5,955 @$1.50(1/200A)	9						
(3) Transportation @$525/MO/MY	32						
TOTAL	113	13	9	9	20	20	44

Continued

	COST X 1000		
	Operational Zone 4	Delphi Regions 17	20
	1,368,180A	895,960A	472,220A
(a) Year 1			
(1) Personnel-Professional 4.0 MY	96		
Temporary 27.3 MY	217		
(2) Traps- 136,818 @$1.50(1/10A)	205		
(3) Transportation @$175/MO/MY	66		
TOTAL	584	383	202
(b) Year 2			
(1) Personnel-Professional 2.0 MY	48		
Temporary 9.1 MY	73		
(2) Traps- 27,364 @$1.50(1/50A)	41		
(3) Transportation @$350/MO/MY	47		
TOTAL	209	137	72
(c) Year 3 and Thereafter			
(1) Personnel-Professional 1.5 MY	36		
Temporary 3.4 MY	26		
(2) Traps- 6,841 @$1.50(1/200A)	10		
(3) Transportation @$525/MO/MY	31		
TOTAL	103	67	35

Continued

	COST X 1000		
	Operational Zone 5	Delphi Regions 21	22
	512,255A	434,690A	77,565A
(a) Year 1			
(1) Personnel-Professional 2.0 MY	48		
Temporary 10.3 MY	81		
(2) Traps- 51,225 @$1.50(1/10A)	77		
(3) Transportation @$175/MO/MY	26		
TOTAL	232	197	35
(b) Year 2			
(1) Personnel-Professional 1.5 MY	36		
Temporary 3.4 MY	26		
(2) Traps- 10,245 @$1.50(1/50A)	15		
(3) Transportation @$350/MO/MY	21		
TOTAL	98	83	15
(c) Year 3 and Thereafter			
(1) Personnel-Professional 1.0 MY	24		
Temporary 1.3 MY	10		
(2) Traps- 2,561 @$1.50(1/200A)	4		
(3) Transportation @$525/MO/MY	14		
TOTAL	52	44	8

Continued

	COST X 1000			
	Operational Zone 6	Delphi Regions 25	27	28
	621,900A	89,639A	47,801A	484,460A
(a) Year 1				
(1) Personnel-Professional 2.0 MY	48			
Temporary 12.4 MY	98			
(2) Traps- 62,190 @$1.50(1/10A)	93			
(3) Transportation @$175/MO/MY	30			
TOTAL	269	39	21	210
(b) Year 2				
(1) Personnel-Professional 1.5 MY	36			
Temporary 4.2 MY	33			
(2) Traps- 12,438 @$1.50(1/50A)	19			
(3) Transportation @$350/MO/MY	24			
TOTAL	112	16	9	87
(c) Year 3 and Thereafter				
(1) Personnel-Professional 1.0 MY	24			
Temporary 1.6 MY	13			
(2) Traps- 3,110 @$1.50(1/200A)	5			
(3) Transportation @$525/MO/MY	16			
TOTAL	58	8	4	45

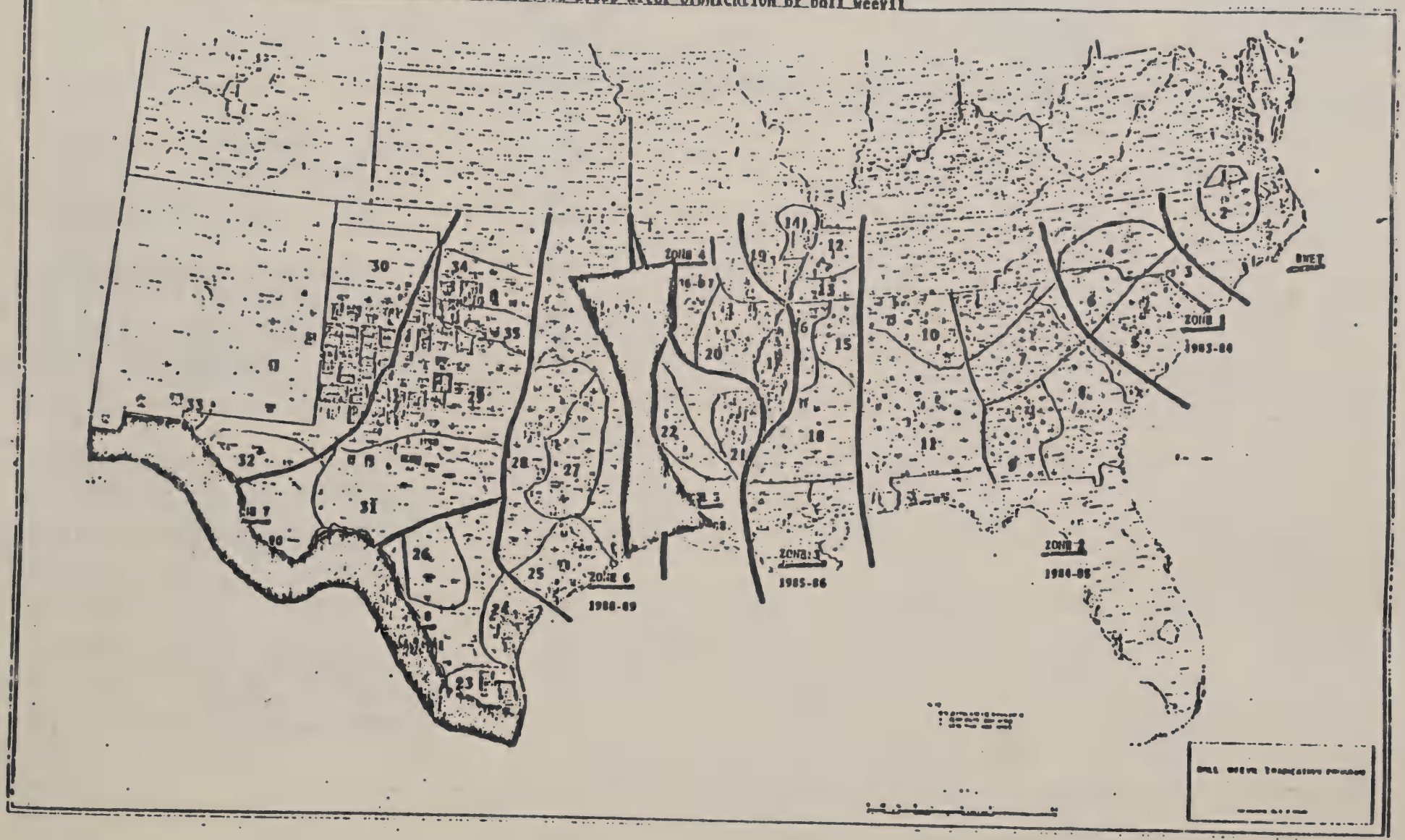
Continued

	COST X 1000			
	Operational Zone 7	Delphi Regions 29	31	35
	1,236,726A	946,081A	132,168A	158,477A
(a) Year 1				
(1) Personnel-Professional 4.0 MY	96			
Temporary 24.7 MY	196			
(2) Traps- 123,672 @$1.50(1/10A)	186			
(3) Transportation @$175/MO/MY	60			
TOTAL	538	412	57	69
(b) Year 2				
(1) Personnel-Professional 3.0 MY	72			
Temporary 8.3 MY	68			
(2) Traps- 24,735 @$1.50(1/50A)	37			
(3) Transportation @$350/MO/MY	47			
TOTAL	224	171	24	29
(c) Year 3 and Thereafter				
(1) Personnel-Professional 2.0 MY	48			
Temporary 3.1 MY	24			
(2) Traps- 6,184 @$1.50(1/200A)	9			
(3) Transportation @$525/MO/MY	32			
TOTAL	113	86	12	14

Continued

	COST X 1000			
	Operational Zone 8	Delphi Regions 23	24	26
	418,085A	278,820A	118,849A	20,416A
(a) Year 1				
(1) Personnel-Professional 2.0 MY	48			
Temporary 8.4 MY	66			
(2) Traps- 41,808 @$1.50(1/10A)	63			
(3) Transportation @$175/MO/MY	22			
TOTAL	199	133	57	10
(b) Year 2				
(1) Personnel-Professional 1.0 MY	24			
Temporary 2.8 MY	22			
(2) Traps- 8,362 @$1.50(1/50A)	13			
(3) Transportation @$350/MO/MY	16			
TOTAL	75	50	21	4
(c) Year 3 and Thereafter				
(1) Personnel-Professional 1.0 MY	24			
Temporary 2.0 MY	15			
(2) Traps- 2,090 @$1.50(1/200A)	3			
(3) Transportation @$525/MO/MY	19			
TOTAL	61	41	17	3

Fig. 4. Possible containment zones to prevent reinfested areas after eradication of boll weevil



V Capital Outlay

Table 4 Capital Outlay by Year and Zone. This estimate includes vehicles, radios, ground spray equipment and miscellaneous equipment.

Year	1	2	3	4	5	6	7	8	Total X 1000
1983	6,583								6,583
1984		7,690							7,690
1985			1,655						1,655
1986				2,487					2,487
1987					344				344
1988						350			350
1989							700		700
1990								350	350
Total									20,159

VI. Regulatory Requirements

Regulatory authority to execute the suppression technology and perform certain other actions is essential for program success. The authority for the required regulations rests in the states. Action to insure compliance will be a joint endeavor of state and USDA regulatory agencies (State Departments of Agriculture and APHIS, USDA). Specifics of required regulatory authority include:

1. State-Federal parallel quarantine authority to quarantine the zones under treatment and those cleared of boll weevil until cleared from United States. Regulated articles would include the boll weevil, gin trash, contaminated cotton pickers and other equipment and articles deemed hazardous.

2. Access and entry under State authority. We must be able to enter all cotton fields to execute control and survey operations.

3. State and Federal authority and committment to execute all phases of the program on 100 percent of the cotton acreage. All cotton, commercial and otherwise, must be subjected to program operations.

4. Authority to require reporting of cotton acreage by the grower to insure all acreage is included in the program. The involvement of ASCS in this activity is essential.

5. State-Federal authority to purchase and destroy cotton which may pose an undue hazard to program objectives because of difficulty in execution of program. This generally entails small plantings located at such a distance from the main cotton acreage that costs to do program suppression is prohibitive.

6. State authority to prohibit planting of noncmmerccial cotton in program operations area or treat such cotton with an effective boll weevil insecticide on a prescribed schedule to prevent production of diapause boll weevils. This applies primarily to ornamental plantings and to research plots.

7. State authority to take necessary action to preevent volunteer cotton and alternate host plants where applicable for jeopardizing program objectives. In most cases, this could result from poor plant destruction in the fall in the more southerly areas of the Cotton Belt.

8. State authority to collect and disburse grower funds contributed as their share of costs.

9. State authority to set optimum planting and crop destruction dates during the period of program operations (2 years).

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